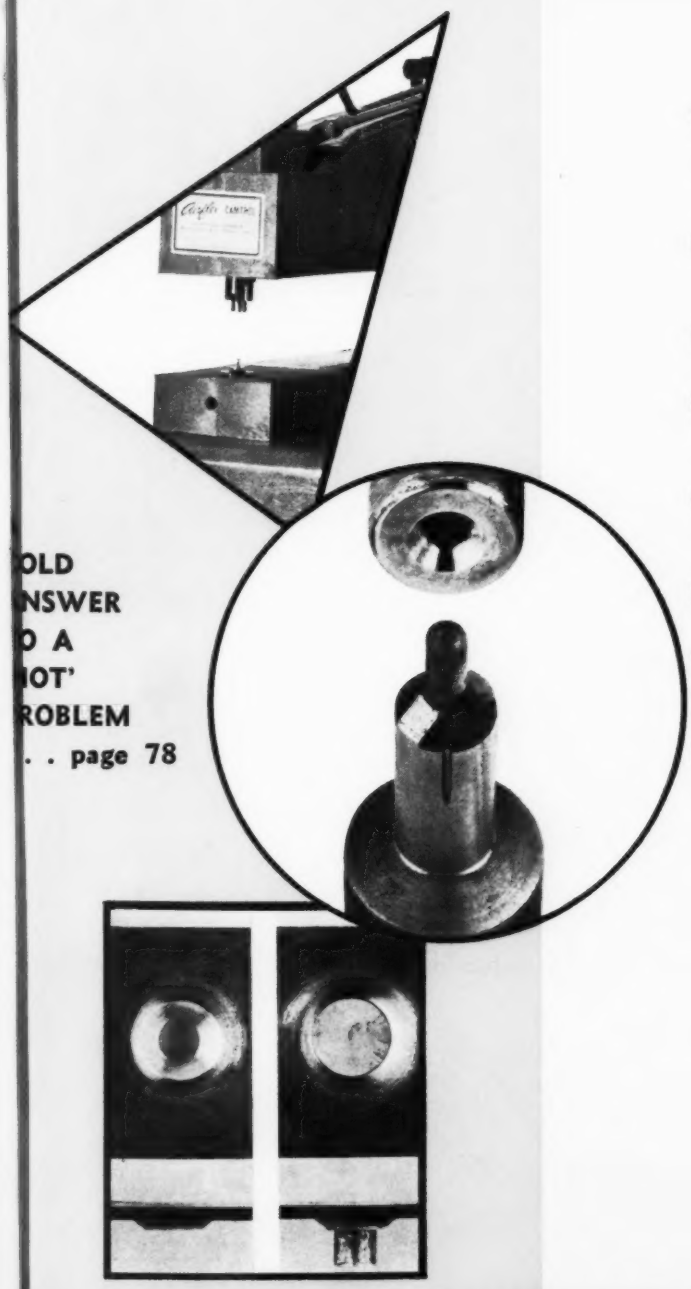
JANUARY 1958

TOOLING & PRODUCTION



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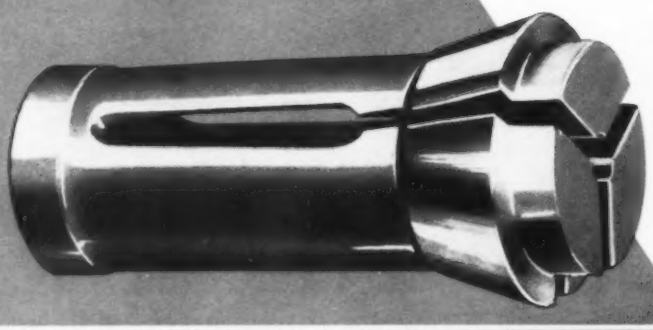
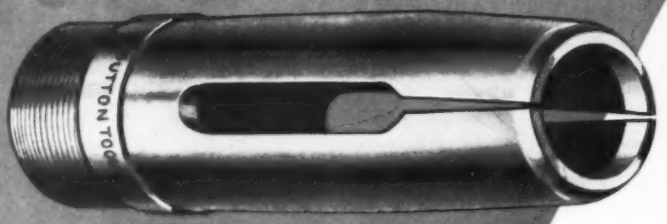


Collets and Feeders



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HELICAL DIE MAKERS
5/32" taper per foot, and .006 per inch. High speed steel reamers with a high helix angle for machine reaming.

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¼" taper per foot. Designed for machine or hand reaming standard taper pin holes.

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For machine reaming standard dowel pin holes. Sets from ⅛" thru ½".

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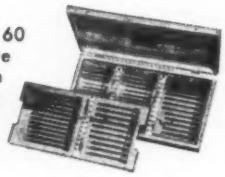
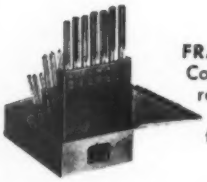
Wide range of 60 reamers for wire gage sizes from (.2280) #1 thru (.0400) #60.





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CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

JANUARY 1958
VOL. XXIII—No. 10
GEORGE J. HUEBNER, Founder

PERSONALLY SPEAKING

Dear T&P Reader:

"The man who needs a new machine tool is already paying for it." So says the advertising slogan of Jones & Lamson Machine Company. I agree. In fact, the chances are good that the man who needs a new machine tool will never even know how many dollars went down the drain while he and his board of directors put off the inevitable day of replacement.

All of you who read T&P know that this is a very real problem. I once knew a man who fired three of his key people because a management counseling firm proved to him that he had lost money for years on old equipment. And, the sad part of this tale is that his managers had all been begging him to loosen up the purse strings and replace the old with new, fast and efficient machine tools.

Fortunately, some enlightened managements are approaching the replacement problem with a vigorous scientific attitude. As I write this, Nyles V. Reinfeld, our Contributing Editor in the scientific management area, is holding the first of three seminars on machine tool replacement and amortization. Some thirty progressive companies have sent their key men to this seminar in Cleveland. Similar meetings will be held in Indianapolis and Chicago. You see, there is hope that the "ride by the seat of your britches" management technique (or lack of technique) is being replaced by scientific investigation.

Perhaps you read the article on page 77 of our December issue called, "Algebraic Model Helps Make Decisions on Machine Tool Replacement." Ed Varnum of Barber-Colman Company is the author and while, at first blush, the technique seems rather formidable, it is actually an excellent example of a fine "operations research" approach to the subject. If you haven't read this article I hope you will, because I'm sure you will benefit from a knowledge of the technique. And, I'd be happy to hear what you have to say about its application in your plant.

Cordially yours,

Ray Huebner

Publisher

TOOLING & PRODUCTION

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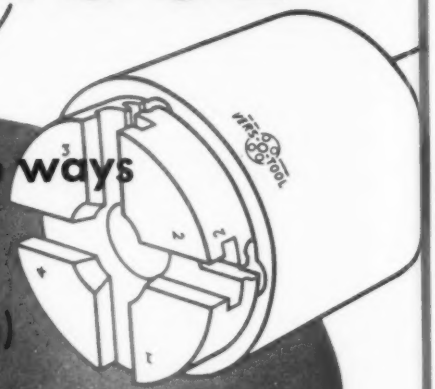
lets you use the same head – two ways

- with chasers . . . (for threading)
- with cutters . . . (for hollow milling)



CIRCULAR CUTTING TOOLS reduce costs and speed production on threading jobs, end forming and turning.

GROUND THREAD CHASERS provide more threads per grind—and you can regrind to a full 270° of chaser circumference.

BASIC DESIGN SIMPLICITY— fewer moving parts —insures long, trouble-free performance.

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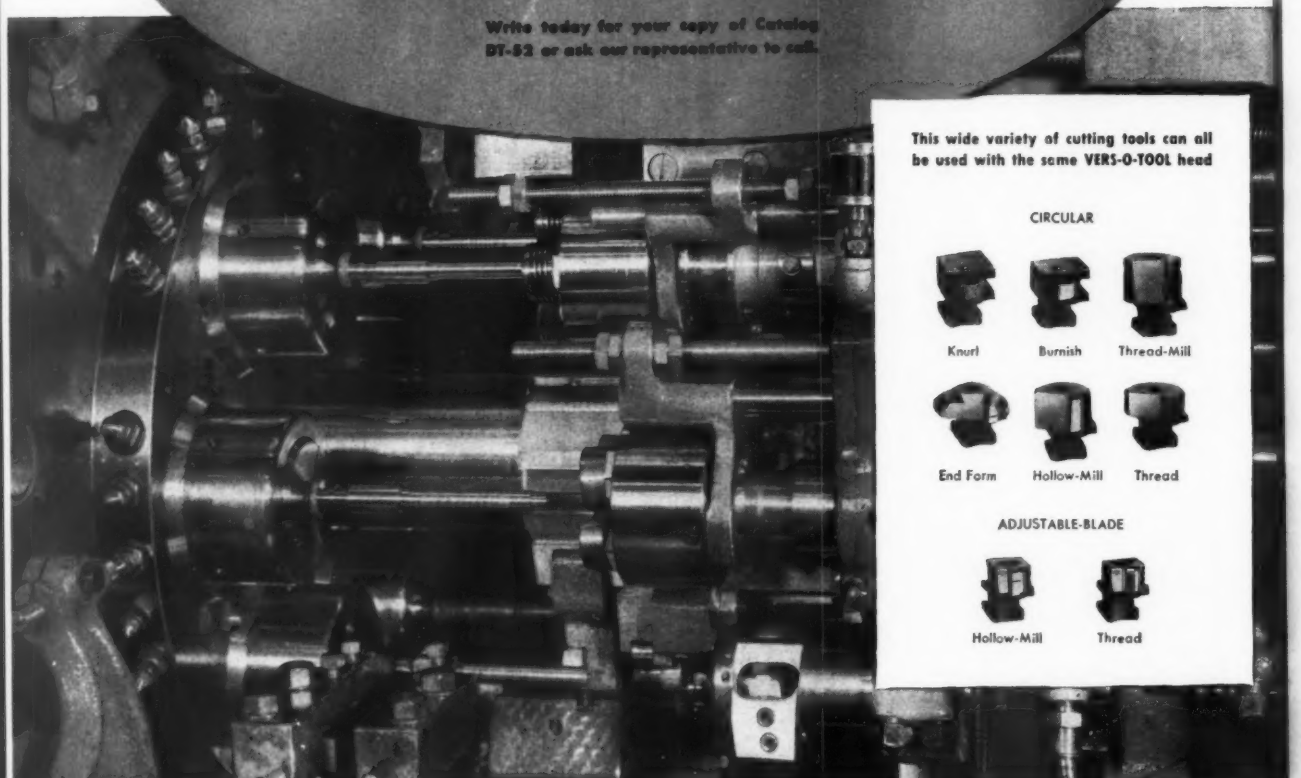
Write today for your copy of Catalog BT-52 or ask our representative to call.



This wide variety of cutting tools can all be used with the same VERS-O-TOOL head

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Three Namco VERS-O-TOOLS, on this 1¼" RA-6 Acme-Gridley Bar Automatic, hollow mill the stem and cut 2 thread diameters on cast bronze valve stem.

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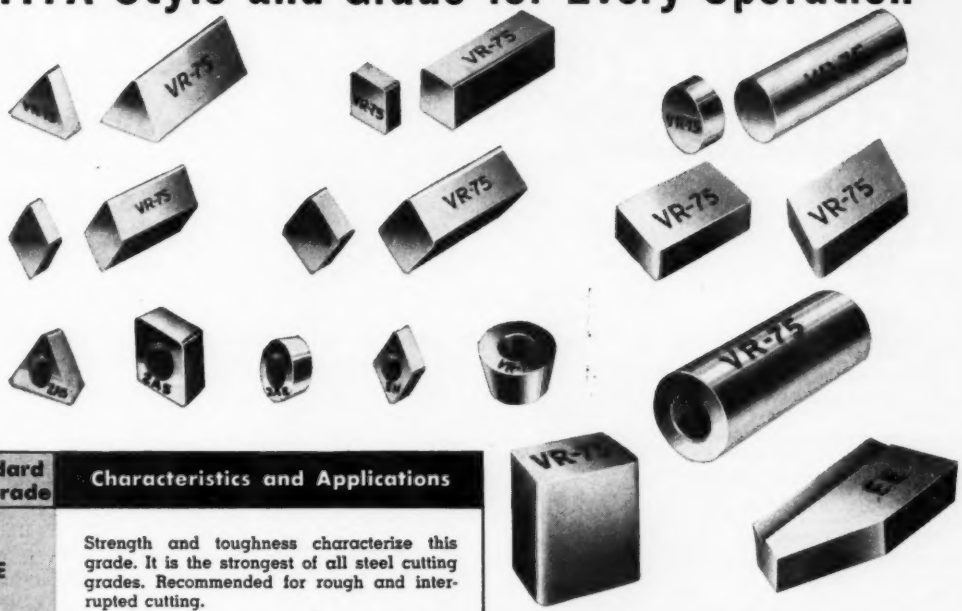

Standard V-R Grade	Characteristics and Applications
EE	Strength and toughness characterize this grade. It is the strongest of all steel cutting grades. Recommended for rough and interrupted cutting.
EM	A general purpose steel cutting grade with good wear-resistant property.
VR-75	A tough heat-resistant general purpose steel cutting grade. Especially recommended for severe applications where high heat is generated.
E	A hard grade with good abrasion resistance. Recommended for medium and light machining and boring of carbon and alloy steels.
EH	The hardest and most abrasion-resistant steel cutting grade. Recommended for high speed, light finishing cuts and precision boring.
2A5	A grade for general purpose machining of cast iron, non-ferrous metals and non-metallics. It has good strength and superior abrasion-resistance in excellent balance.
2A7	The hardest and most wear-resistant grade for cast iron, non-ferrous metals and non-metallics. Recommended for light, fast finishing cuts and for machining to close tolerances such as required for precision boring.

Standard and Special Throw-away Type and Long Inserts for All Mechanical Toolholders

Standards. Vascoloy-Ramet manufactures and stocks a complete line of standard cemented carbide inserts for straight and lead angle turning, facing, chamfering, profiling, grooving, face milling, planing, shaping, and other operations commonly performed with mechanical toolholders.

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Let your V-R qualified field service engineer show you the economies of tooling with V-R carbide inserts. Call him today, or write.

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See the latest developments in carbide tooling at our Booth No. 1615 at the Metals Show, Chicago, November 4-8.

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CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS C-642

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SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

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CIRCLE INFORM-A-GRAM KEY NO. 7

"The Tool & Die Makers Surface Grinder"

Harig's NEW

TML 6x12 SURFACE GRINDER

THE NEW TML BY HARIG PROVIDES EXTREMELY FAST AND ACCURATE GRINDING—STURDY CONSTRUCTION—ADVANCED DESIGN WITH ECONOMY IN MIND. . . *THE LOW COST WILL PLEASE YOU!*

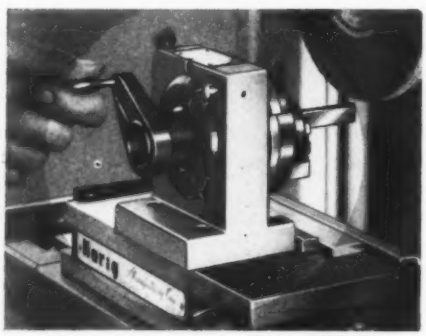
OUTSTANDING FEATURES

- Solid one piece construction of spindle housing and vertical slide.
- Elevating screw centrally mounted.
- Combination "V" and flat ways assure positive alignment.
- Angular rack and pinion mounting distributes wear equally along rack and pinion face.
- Motorized Spindle, dust collector and water unit available.

SPECIFICATIONS

Longitudinal Travel	12-3/8"
Cross Feed Travel	7"
Vertical Working Height (Under 7" dia. wheel)	0" to 12-3/4"
Platen Working Area	6" x 12"
Grinding Wheel	7" x 1/2" x 1-1/4"
Elevator Handwheel Graduation	.0005
Cross Feed Handwheel Graduation	.001

Remember: Harig's Famous Precision is in Evidence Throughout!



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"The Latest Advancement in Perforator Grinding"

Fast, accurate perforator grinding fixture — hand crank for easy rotation of index plate, single locking screw for making quick set-ups. Easily grinds irregular shaped perforators concentric with shank within ±.0002 accuracy. Also can be used as milling, boring and inspection fixture. NEW! RADIUS DRESSER ARM—attachment makes Grind-All Fixture a highly accurate radius dresser.

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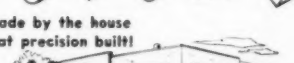

Harig Manufacturing Corp

5761 W. Howard St. - Chicago 31, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 8

Talk of the Month

BIG BUSINESS GIVES TECHNICAL ASSISTANCE TO SMALL BUSINESS

by Dr. Guy Suits

Vice President and Director of Research

GENERAL ELECTRIC COMPANY

Schenectady, New York

INDUSTRIAL RESEARCH IS AN INVESTMENT in the future involving long-term risks. A small number of highly productive research ventures must carry the burden of the many unsuccessful scientific explorations that are necessary to insure that hidden opportunities are not overlooked. The financial investment required to support a large-scale research program is very substantial, the risks are considerable, and the period before dividends are declared is frequently long. Here large companies have an important role to play.

Possessing the necessary physical, economic, and human resources, and with a great diversity of technological interest, the major industries have the unique opportunity to support the risk-type of large-scale research effort necessary to guarantee continued technological progress. All companies get very substantial benefits from the research contributions made possible by the long-term risks of large industry.

A second unique value in large-scale industrial research is the scope of this research effort — the breadth and depth that result from the mobilization of a multiplicity of skills. Going hand in hand with the high order of specialization demanded by our increasingly complex technology is the need for team effort. An all-out attack on a major research problem — such as man-made diamonds, for example — demands teamwork involving many highly specialized

. . . *Continued on page 12*

Adapted from a talk submitted to the President's Committee on Technical and Distribution Research for the Benefit of Small Business.

STRIPPIT *tooling versatility*

keeps presses working, not waiting!

Nothing to mount on the ram, nothing to align or adjust — just place your Strippit setup in the press and start the run.

That's how Strippit versatility pays off. Any good bench man can mount these independent self-contained punching and notching units in any template pattern within press capacity. New Strippit setups can be kept ready for the press, virtually eliminating down-time.

For flatwork, extrusions, structurals from the smallest gauge to 3/4" mild steel, Strippit gives you these extra advantages:

• The effect of quick-change dies without die-making or die-spotting • Speed over drilling — plus no deburring • Units re-usable over and over • Readily removable punches and dies • Ease, accuracy of template mounting — pilot pin centered on punch • Each unit complete — permanently aligned, fully guided, self-stripping.

For unlimited feeding of work, Strippit Type CD and JD (heavy-duty) Punch and Die Assemblies are readily template-mounted to press ram and bed in any desired pattern.

Write today for all details and a demonstration by a Strippit mobile unit at your plant.

Special tools made up to your specifications. Warehouse facilities in Chicago and Los Angeles.

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WALES STRIPPIT COMPANY

212 Buell Road, Akron, New York

One of a complete line of Strippit vertical and horizontal hole punching units in capacities from the lightest material to ¾" mild steel. Wide choice of die heights, shut heights and throat depths.

Also, 90-degree Corner Notching Units in 3" x 3" and 5" x 5" sizes, plus V, Radii and many special shape notching units. Capacities to ⅛" in mild steel.

Manufactured in Canada by Strippit Tool & Machine Limited, Brampton, Ont.

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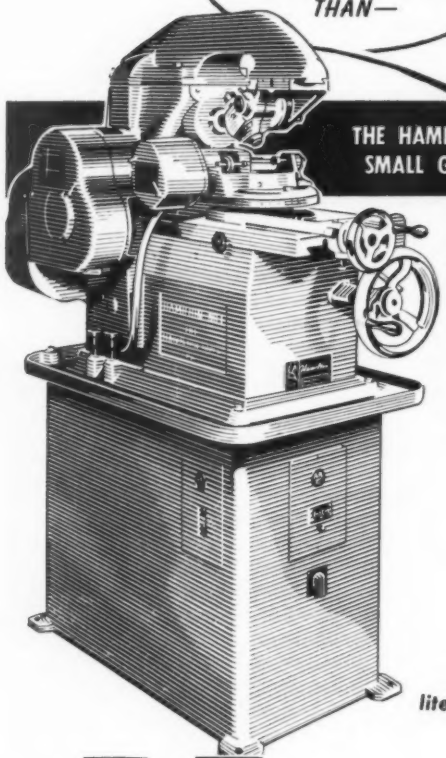
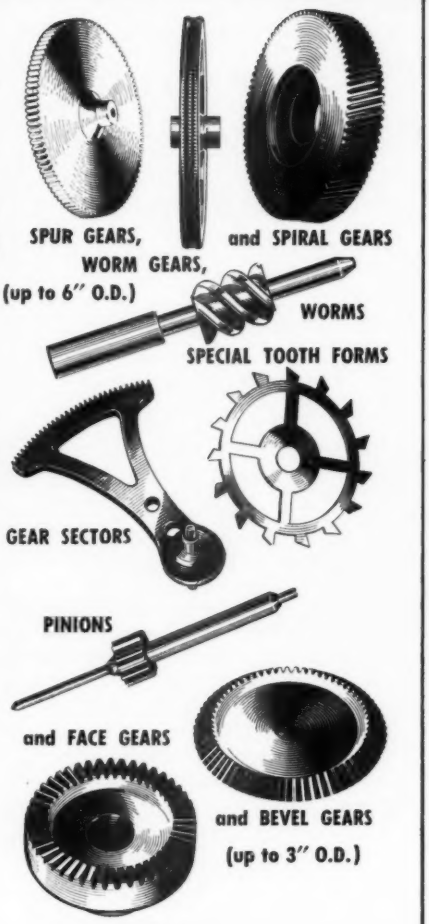
ALL THE **PRODUCTION** YOU'LL *EVER* WANT — ALL THE **PRECISION** YOU'LL *EVER* NEED

THE HAMILTON No. 1-B PRECISION SMALL GEAR HOBBING MACHINE





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THESE ARE REPRESENTATIVE USERS OF HAMILTON GEAR HOBBING EQUIPMENT

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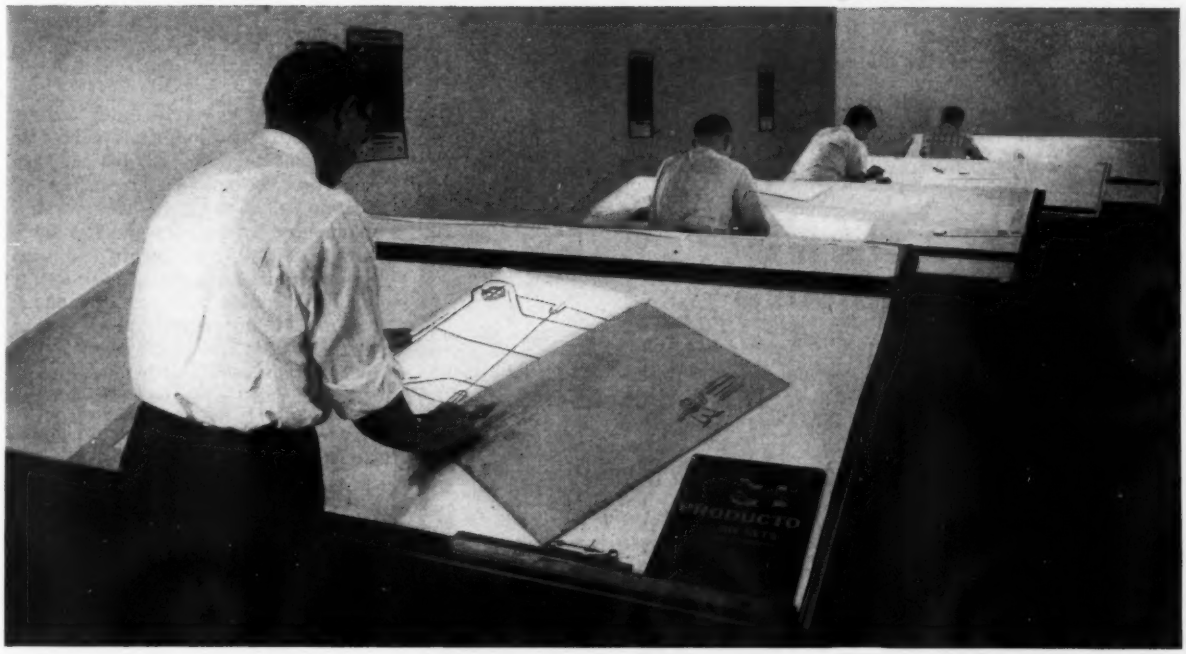
THE HAMILTON TOOL COMPANY • 832 SOUTH NINTH STREET • HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 10

Why the Die Designer Prefers PRODUCTO Die Sets



He can specify Producto with complete confidence

The die designer likes to specify Producto die sets on his blueprints because they are a nationally-accepted "brand" They're easy to get anywhere.. and delivery is prompt.

He favors Producto because he knows he never has to compromise his die design. Even if the die layout is a little unusual, he will be able to select a die set to accommodate it from Producto's wide range of thicknesses and styles.

He also knows Producto has the equipment that can cut his tooling costs by letting him adapt his sets to a more economical *basic* design. Only Producto offers him complete foundry, pattern-making, welding and machining services for his special requirements.

The die designer recognizes Producto's Qwik-Fit Guide Pins as an important new feature that die makers want. He specifies them because they save up to 75% of the time normally required for die set assembly and disassembly.

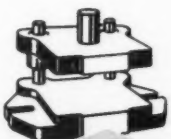
The die designer likes to use Producto's new catalog, the industry's most practical tool. His die layout is simplified when he uses Producto die set templates. And Producto provides him with cost-saving ideas in the DIE SET DIGEST.

Most important, he can depend on *consistent* Producto die set accuracy to transfer from the drawing board to the press the precision and ingenuity of his die design.

Yes, the designer has found that Producto die sets justify his confidence in specifying Producto. You will, too.

TWO FREE AIDS to more economical, efficient use of die sets are available from Producto. All-new CATALOG NO. 11 makes ordering and selection job easy. DIE SET DIGEST gives valuable tips for designers, builders and users of dies. Write for them today.

THE PRODUCTO MACHINE COMPANY
970 Housatonic Ave., Bridgeport 1, Connecticut



Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

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CIRCLE INFORM-A-GRAM KEY NO. 12

. . . Month's Talk from page 8

skills: in this case, physicists skilled in experimental work at extremely high temperatures and pressures, chemists familiar with the kinetics of phase transformation, specialists in crystal structure, and engineers experienced in the design and construction of unusual mechanical equipment.

Industrial research today differs from that of a generation or so ago. The lone inventor in his solitary laboratory, once the mainstay of technological progress, is now supplemented by the scientific task force armed with the elaborate technical gear required for an all-out attack on the complex problems of modern science. Many schoolboys know that Alfred Nobel invented dynamite, but it is not so easy to answer the question, "Who invented the atomic bomb?"

Scientific Cross-Fertilization

Another reason for the effectiveness of large-scale research, covering a wide range of interests, is the cross-fertilization that takes place among scientists who are experts in different fields. Each scientist, working in his own field, is stimulated by his contacts with the development of concepts, techniques, and instrumentation in neighboring fields, with important benefits to his own progress as an individual researcher. Thus, team activity triggers a chain-reaction of ideas.

In such an environment the scientist has readily available to him the advice and assistance of specialists from many fields. An electronics research man needs a special alloy or a new ceramic to meet certain critical requirements; he makes his wants known and the specialized skills of metallurgists and ceramists are at his disposal, together with the appropriate technical facilities.

Facilities for Specialized Ventures

Also among the assets to be found in large industry is the ability to make heavy investments in research facilities for specialized research ventures. At our laboratory we have a building that is more like a factory than a laboratory except that its production-size equipment is devoted to research. Here large arc-furnaces, extrusion presses, and rolling mills have a low use factor that could never be justified in a manufacturing plant, but their availability is vital to a research program aimed at finding better metal and ceramic materials for application throughout our company.

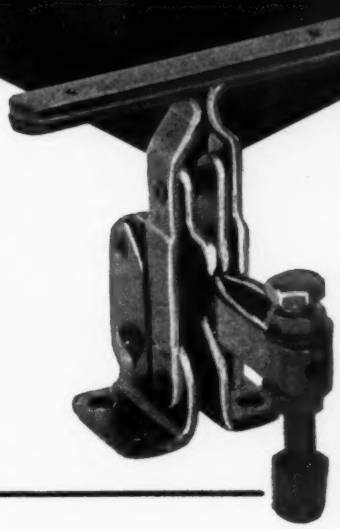
. . . *Continued on page 20*

MAKE WESPO YOUR DESIGN STANDARD for ALL WORKHOLDING NEEDS

WESPO TOGGLE CLAMPS & PLIERS

Over 80 types and sizes. From 5/8" Midget to 12 5/8" Clamp. PLIERS — from 1 3/16 Jaw Midget to 4 1/4 wide Jaw.

WESPO Toggle Clamps are made in types and sizes to meet all workholding needs, light, medium and heavy duty. Features include: REAMED HOLES, for better bearing, HARDENED BUSHINGS — SERRATED to prevent turning — HIGH TENSILE STRENGTH RIVETS for longer service.



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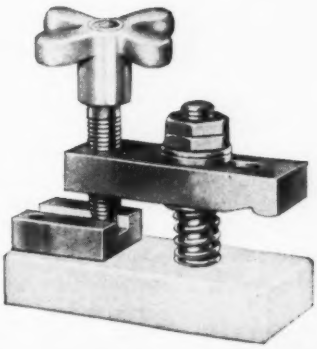
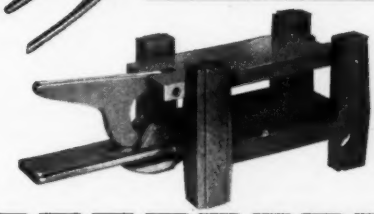
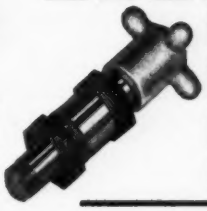
Over 170 Types and Sizes

WESPO fixture clamp assemblies save up to 70 percent on your own designing and machining. They are used as standard by a large number of leading manufacturers.







WESPO COMPONENTS

Over 1,000 types and sizes available from stock.

WESPO parts are precision manufactured of quality steel — heat treated and rust-proofed. They are designed for heavy duty and long wear and have proved their value in many industries.

ADJUSTABLE SPINDLES FOR TOGGLE CLAMPS with BONDED NEOPRENE CAPS

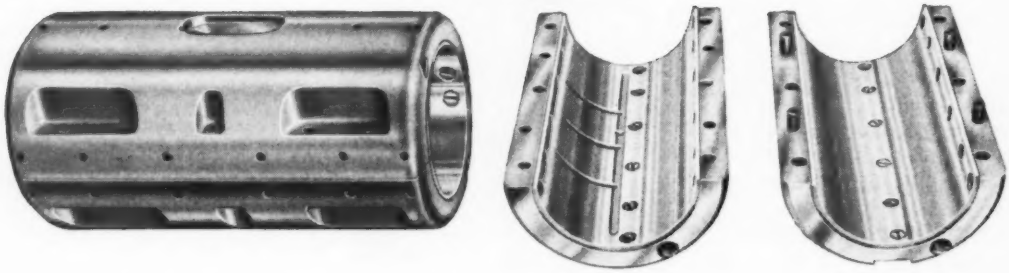
Write for Catalogs —
TOGGLE CLAMPS & PLIERS, FIXTURE CLAMPS and PARTS

WEST POINT MFG. CO.
26935 W. 7 Mile Road • Detroit 19, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 13

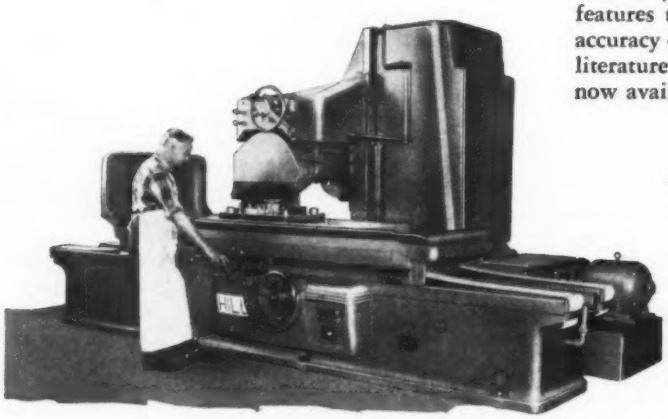
Novel Design provides *Astonishing Bearing Life*

The life of the HILL front spindle bearing on HILL horizontal spindle hydraulic surface grinders is truly astonishing. This bearing has been an *exclusive* HILL feature for more than 15 years. The necessity of replacement, under constant use, is practically unknown.



• • • The front spindle bearing on HILL horizontal spindle hydraulic surface grinders was engineered by the HILL ACME COMPANY and has proven in the field to operate indefinitely. An alloy bronze bushing is fastened to a semi-steel casting with brass screws. The bronze bushing is undercut lengthwise in four equidistant locations on the outside diameter to allow for spindle expansion. (Darker areas in photo show undercut sections.) A perfect bearing surface is established in the I.D. of the bronze directly opposite the undercut sections. Oil is forced into specially designed concave relief areas which act as oil wedges assuring long bearing life. Hardened dowel pins guide the two halves together to their original position. The bottom half of the bearing has an oil return slot shown at the edge of the half section on the outside diameter. Note that there are NO oil grooves in this bottom half or in the quarter half of the top section. The shaft rotation spreads the oil film from the oil distribution grooves to the perfect bearing surfaces. Any additional oil grooves would act as scrapers and be detrimental to the oil film formed around the spindle.

This is just one of the many exclusive construction features that result in the longer life and permanent accuracy of HILL heavy duty surface grinders. Detailed literature on these high-precision machine tools is now available.



24" x 24" x 72" HILL horizontal spindle surface grinder grinding blanking dies to extremely close tolerances. Also built in Vertical Spindle design.

THE HILL ACME COMPANY

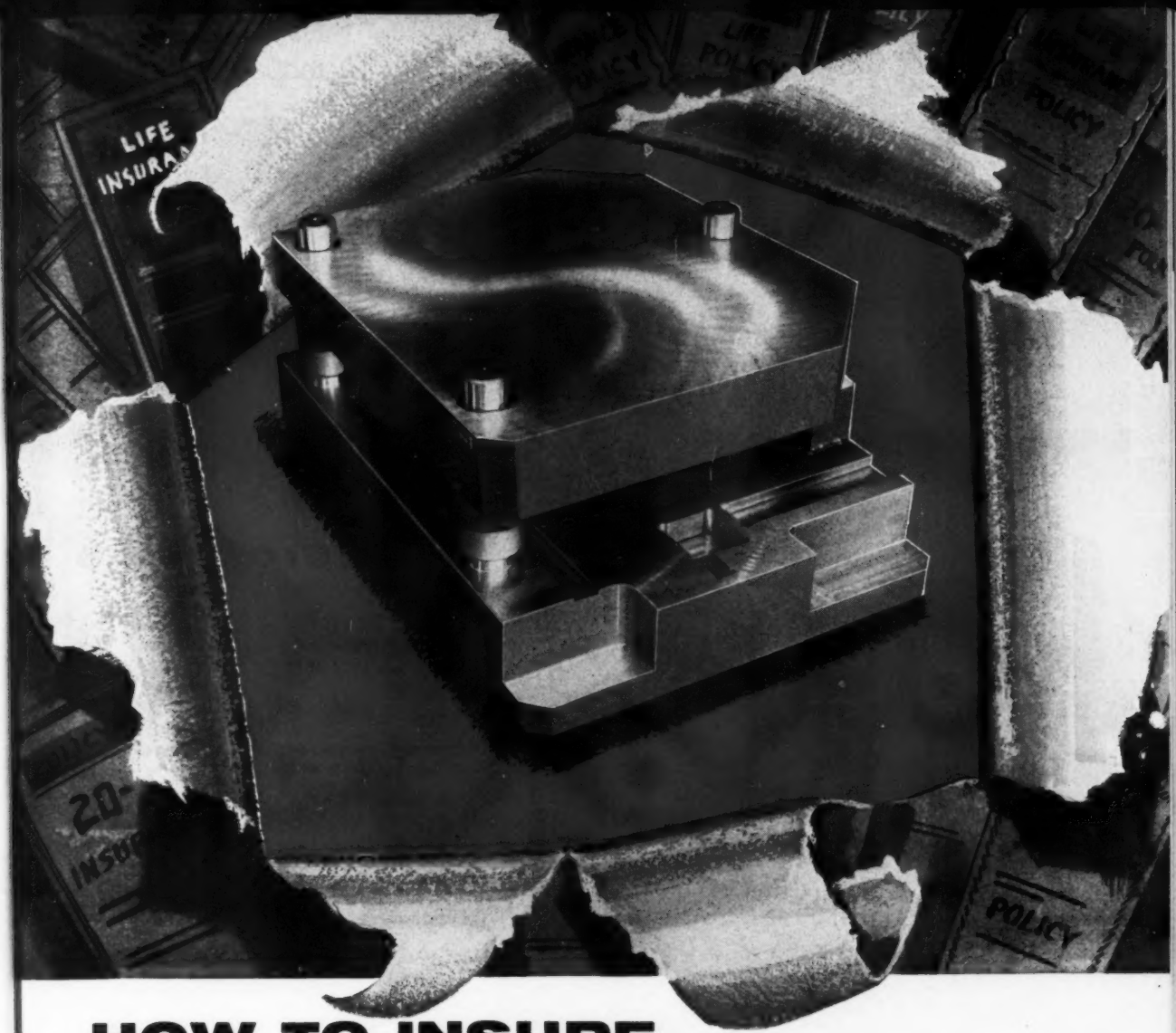
HILL DIVISION . . . . . ESTABLISHED 1882

1201 West 65th Street • Cleveland 2, Ohio

HOOS FOR INDUSTRY

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING • TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

CIRCLE INFORM-A-GRAM KEY NO. 14



HOW TO INSURE YOUR COSTLY DIES . . .

DON'T buy "bargain-price" special die sets!

When you need a special die set it is usually for an expensive die . . . one that you really should protect.

The few dollars extra you may pay for a "Detroit-built" special are the cheapest insurance you can have that your costly die will get maximum protection.

Believe us—there is a lot more to a good special die set than some steel plate and a few pins and bushings.

The protection your costly dies get from Detroit-built die sets is not accidental. It is built into every die set we make—standard or special—and we've been doing it for 30 years.

Sure, you can buy cheaper die sets, but they can be awfully expensive, too.

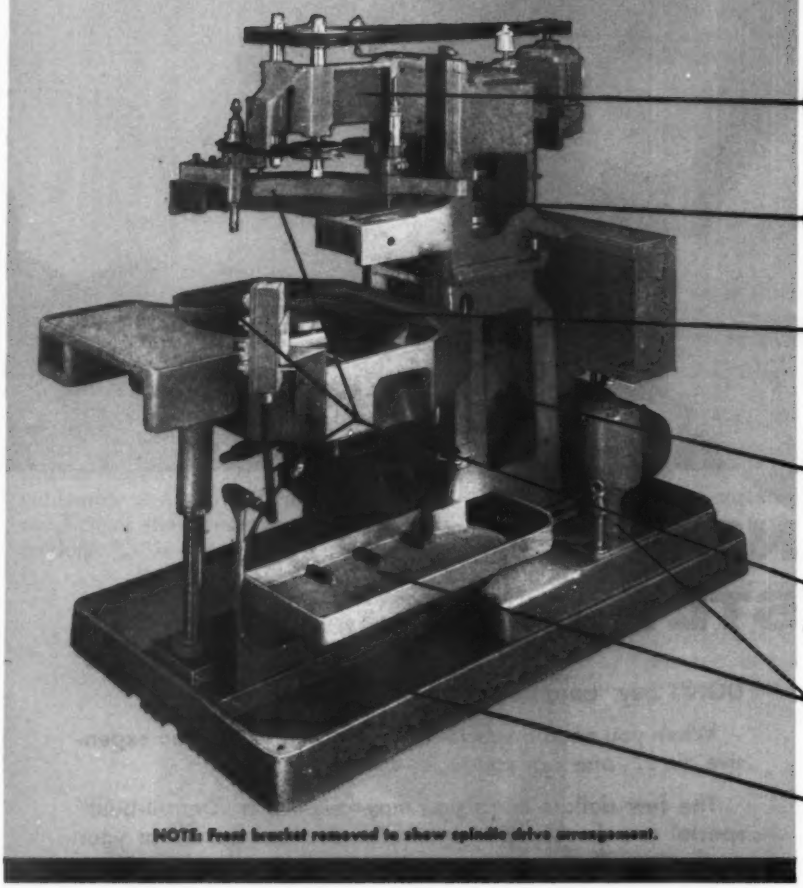
FFICES IN PRINCIPAL INDUSTRIAL CENTERS

Detroit
DIE SET
CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 15

MULTIPLE TOOLING . . .
RAPID CHANGE-OVER . . .
WHEN YOU BUILD PRODUCTION MACHINES
AROUND Bodine



NOTE: Front bracket removed to show spindle drive arrangement.

BASIC UNITS

- Central and flexible jack shaft drive to vertical spindles.
- Variable, quick-change, cam-controlled, synchronized vertical motion.
- 6 standard interchangeable table indexes, from 10 to 24 stations.
- All power drive through SINGLE main shaft for simple timing and adjustment.
- Ample mounting surfaces for tooling and attachments. Tool mounting areas are standard, making all tooling interchangeable.
- Central coolant system.
- 4 standard Basic Machine sizes.

This is but one of many "usual" examples of exceptional Bodine Basic Unit versatility. It demonstrates how, with standard Bodine Basic Units, "special" machines can be built which combine all of the best features of modern high-speed, multiple-operation production, plus the important added feature of rapid change-over from production of one part to another.

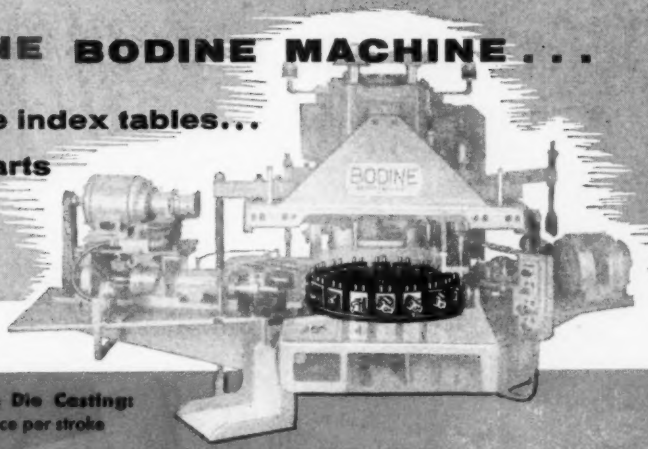
Each of the five parts illustrated, while of different material and requiring an entirely different sequence of operations, was completely processed on this one Bodine. A simple change of dial tables and relocation of tooling kept production and production rates at an extremely high level, and at the same time reduced labor costs and machine down-time to an absolute minimum.

Write Dept. TP-1 today for details on Bodine high production flexibility . . . proved in the field by both large and small manufacturers.

2BD96L

for example... ONE BODINE MACHINE...

with 5 interchangeable index tables...
produces 5 *different* parts



a

Aluminum Die Casting: One piece per stroke

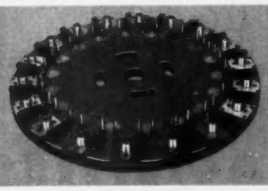
First Operation: Drill, counterbore and tap 3 holes. *Production: 600 pieces

Second Operation: Counterbore 1 hole, tap 3 holes, drill, ream, face and chamfer 2 holes in line. *Production: 600 pieces

b

Aluminum Die Casting: One piece per stroke

Operation: Drill and tap 4 holes, face 2 hubs. *Production: 750 pieces



c

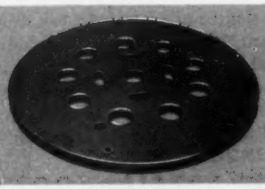
Powdered Metal Casting (Iron-copper mixture): One piece per stroke

Operation: Drill, ream and ball burnish 2 holes. *Production: 400 pieces

d

Steel (B-1113): One piece per stroke

Operation: Drill and countersink 4 holes, ream and tap 1 hole. *Production: 700 pieces



e

Steel (SAE 1012) Stamping: One piece per stroke

Two operations: Counterbore 4 holes, countersink 9 holes, ream and tap 1 hole. *Production: 1,000 pieces per operation

*Production rates are per 50-minute hour.

THE
Bodine
CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

2BD56R

CIRCLE INFORM-A-GRAM KEY NO. 17

NEW YORK

"An irregular-shaped hole being ground to within .0002" on the No. 2 Moore Jig Grinder. The machine can do contour grinding of almost any size and shape."—*from facilities booklet of August W. Holmberg & Co., Inc., Flushing, N. Y.*

MISSOURI

"Two No. 2 Moore Jig Borers...permit Ehrhardt to locate and bore holes accurately and to inspect the finished work."—*from facilities booklet of Ehrhardt Tool and Machine Co., St. Louis, Missouri.*

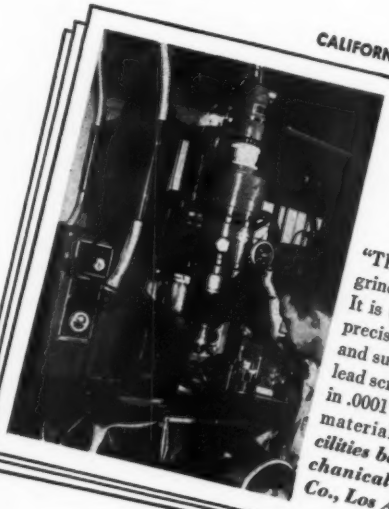
"FACILITIES, FACILITIES, FACILITIES..."

How Leading Tool and Die Shops Across the Nation Feature MOORE Jig Borers and Jig Grinders

Today, top contract tool and die shops often rely on illustrated booklets to sell prospects on their facilities. And they often rely on pictures of their Moore Jig Borers and Jig Grinders to indicate the degree of precision work they can do. It's particularly significant that leading contract shops choose Moore machines for "double duty"—in the toolroom and on the printed page—for these owner-managed firms are understandably deliberate and judicious in selecting machine tools. Write today for detailed bulletins on Moore's top-billed toolroom teammates.

MOORE SPECIAL TOOL COMPANY, INC.
726 Union Avenue, Bridgeport 7, Connecticut

CALIFORNIA



"This precision jig grinder is a Moore No. 2. It is used for producing precision holes, contours and surfaces to accurate lead screw settings within .0001" in heat-treated materials."—*from facilities booklet of Mechanical Specialties Co., Los Angeles, Cal.*

HOLES, CONTOURS AND SURFACES
Moore's *all-new* book tells you how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. $5 in U.S.A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

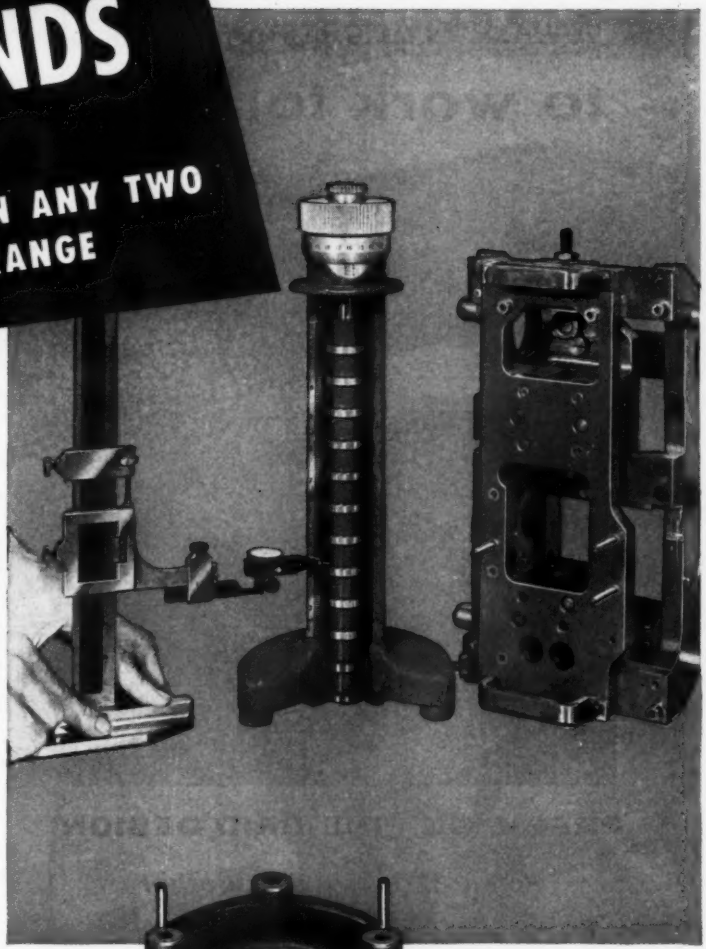
CIRCLE INFORM-A-GRAM KEY NO. 18

SETTING TIME:

10 SECONDS

ACCURACY:

.00005" BETWEEN ANY TWO POINTS IN 12" RANGE



Cadillac PLA-CHEK

SPEEDS ACCURATE INSPECTION from *MINUTES* to *SECONDS*

Designed for easy portability and extreme ruggedness, this 12" Cadillac PLA-CHEK takes little more than 10 seconds to set! Permits surface plate checking and inspections nearly 5 times faster than by ordinary methods.

And, accuracy is assured! Between any 2 points in the 12" range accuracy is guaranteed within .00005".

With a reverse checking plate, a height-gage indicator is easily set for checking the underside of parts. Use of inside micrometers, telescoping and internal cylinder gages gives this gage added versatility. Send coupon TODAY for complete details!

To increase the usefulness of the 12" Cadillac PLA-CHEK Gage, without sacrificing portability, this 6" precision-made riser may be used—upping range to 18".

Cadillac

GAGE COMPANY

P.O. BOX 3806 • DETROIT 5, MICHIGAN

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN

Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name_____

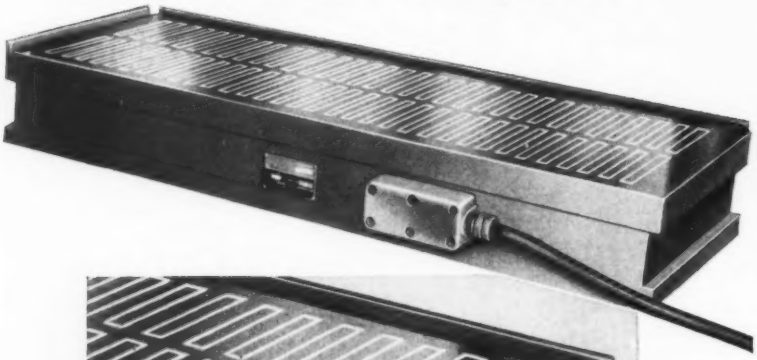
Company_____

Address_____

City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 19

NOW—put this BRAND NEW MAGNETIC CHUCK to work for you!



PRECISION FINE-GRID DESIGN

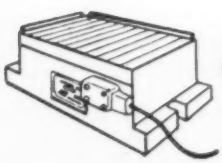
Poles 37% closer together

Greater holding power for small as well as large pieces.

Hard Epoxy resin separators or Magna-Lock special soft metal. Epoxy resin separators are easy to grind in and are particularly suited to electrolytic grinding operations because they resist electrolytic action. Magna-Lock special soft metal is preferred by some and is available as an alternate material for all Magna-Lock fine grid chucks.

Available in all sizes.

It will pay you to get all the facts about this powerful new Magna-Lock magnetic chuck *now*. Write Dept. TP-18



Hanchett **MAGNA-LOCK**
CORPORATION
BIG RAPIDS, MICHIGAN, U. S. A.

Designers and makers of a complete line of magnetic chucks and devices.

CIRCLE INFORM-A-GRAM KEY NO. 20

. . . Month's Talk from page 12

The ability of a large industrial organization to take long-term financial risks assures a continuity of the research program. Research is not like a water faucet that can be turned off and on at will to satisfy an immediate need; the stream of new knowledge must be kept flowing in times of feast and famine or we will lose contact with the source just when we most need nourishment.

Industrial scientific research is a primary source of growth and profitability in modern industry, and it is rapidly assuming its appropriate functional role along with the older industrial functions such as engineering, marketing, and manufacturing. As such, the scope and character of research are determined and justified by the business objectives of the company it serves. In what way does the comprehensive research program of the large company benefit the small business enterprise? . . . in the creation of new products, new markets, and new industries with widespread participation.

Responsibility To Owners

A friend of mine who is the research director of a well-known company, having heard that I was to talk about large business as a source of technical assistance for small business, told me — no doubt facetiously — that he had a sure-fire illustration for me to use. He said that every time he presents his research budget to the owners and managers of his company, somebody comments, "Sure, research is a good thing, but doesn't everybody — including our competitors — get as much advantage from our research as we do?"

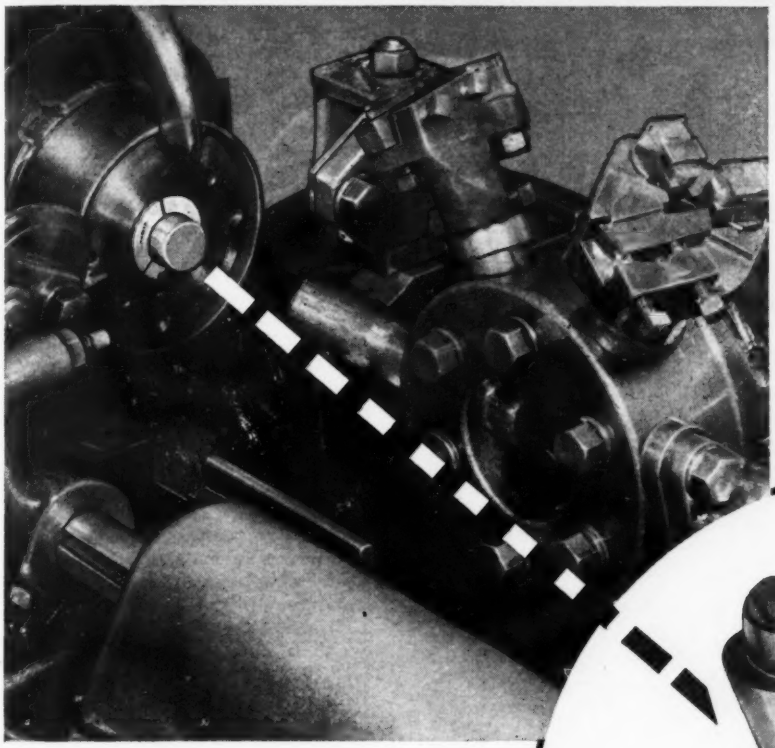
This is an important comment and it concerns a key aspect of industrial scientific research. It is an admitted fact that others do benefit from your research. The sponsor, however, expects his research contribution to enable him to be "first" with new and improved products and thus to broaden his opportunity to serve his customers and to deserve an adequate profit. The new markets thus created will not be served by a single company. Typically, a new market is an opportunity for widespread participation by industrial units large and small, giving full play to the specialized skills of the supplier of materials, components, machinery, and equipment as well as the manufacturer of the complete product or product line.

Fortunately, science is a plentiful well; if pumped energetically — and steadily — it can fill the cup of the

. . . *Continued on page 22*

HARDINGE
ELMIRA, N.Y.

PRECISION PRODUCTS
for BROWN & SHARPE machines



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One Source of Supply Means Purchasing Economy

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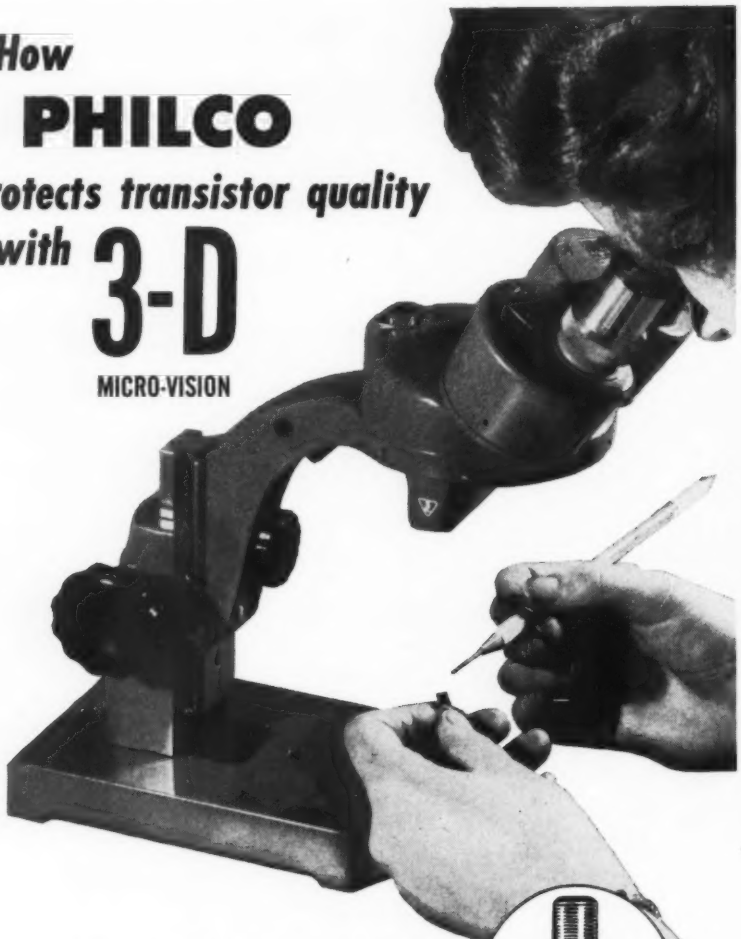
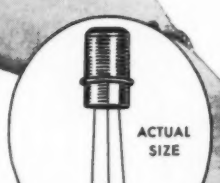
HARDINGE BROTHERS, INC., ELMIRA, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 21

How PHILCO protects transistor quality with 3-D MICRO-VISION





From quality control on automated assembly lines to final inspection, Bausch & Lomb Stereomicroscopes assure precision production at the Lansdale Tube Company, Division of Philco Corporation. Inspectors see clear, sharp magnified views of tiny transistor components barely visible to the unaided eye. Work is seen right-side-up, in natural 3-dimensional relief. Freedom from eyestrain and discomfort increases efficiency. The result: precision standards that assure distortion-free sound in Philco-equipped transistor radios . . . speed and reliability in Philco-equipped computers.

MAIL COUPON TODAY FOR VALUABLE 3-D MICRO-VISION DATA BOOK

BAUSCH & LOMB
SINCE 1853

America's only complete optical source . . . from glass to finished product.

BAUSCH & LOMB OPTICAL CO.
79825 ST. PAUL ST., ROCHESTER 2, N. Y.

Please send me Stereomicroscope Manual D-15, including actual stereo views, how and where to use stereomicroscopes, and Selector-Chart which fits exact model to specific job needs.

NAME.....
TITLE.....
COMPANY.....
ADDRESS.....
CITY.....ZONE.....STATE.....

CIRCLE INFORM-A-GRAM KEY NO. 22

. . . Month's Talk from page 20

pumper, thereby enabling him to continue his efforts, and still yield abundant benefits for others.

Better Values For Customers

The results of research sustain the performing company by providing the innovations that make possible more attractive values for customers. Of course, the principal objective of our research program is to "keep ahead." The fact of the matter is, however, that we must worry about keeping up as well as keeping ahead. Technological progress begins in many sources, and no single laboratory or group of laboratories can expect always to be "first." At best, a large-scale research program can give the company it serves a series of transient opportunities for product leadership. But even at the very least, the supporting company should expect that its research program will appraise new scientific discoveries reported throughout the world of science and thus help the company better serve the wants of its customers in a competitive market.

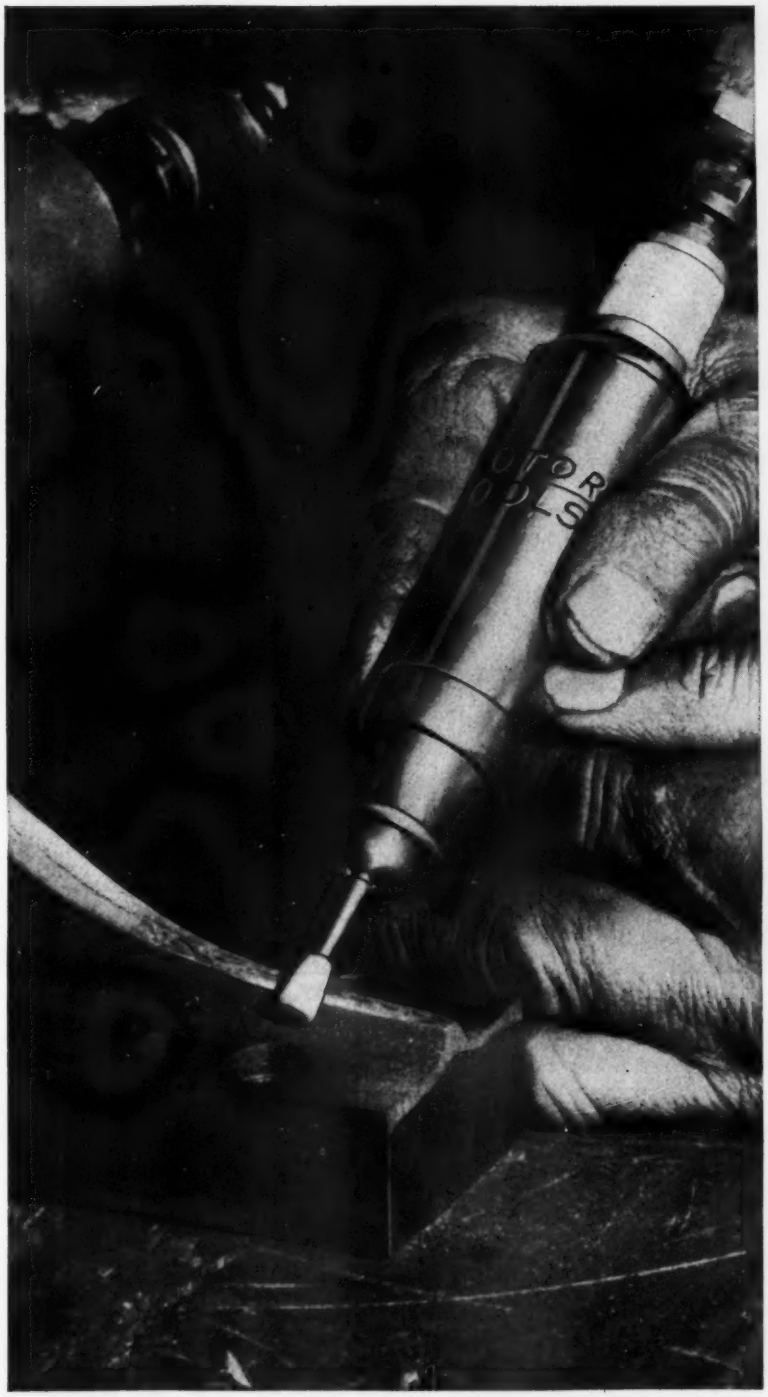
There are many reasons why the same research and development effort that benefits our own company and our customers also benefits other businesses, particularly small businesses. Among the most important of these reasons is the fact that new products created by large-scale industrial research almost invariably create new markets, not only for the company that supported the research, but for many other companies as well.

Impact of Semiconductors

The semiconductor business was born in 1950 and will probably become a billion dollar business by 1967. Actually the industrial impact of this new industry is not adequately measured by one billion dollars. Semiconductor devices, as new and versatile electronic components, have stimulated the growth of many older businesses and have created entirely new ones. Portable radios and communication systems, improved hearing aids, compact computers, automation equipment, improved industrial power conversion equipment, and numerous important applications to weapon technology are among the products which have been rejuvenated or have been born by virtue of semiconductor components.

I hasten to add that in this case as in many others, no one company is solely responsible for the new technology which created the new market opportunities. The invention of the transistor by the Bell Tele-

. . . *Continued on page 25*



Cuts die-grinding time 20%

WITH ROTOR'S 40,000 RPM BLADED TYPE TOOL

JOB: Die grinding. Formerly used bulky turbine type air grinders. Power dropped under load. Switched to Rotor D-03 Pencil Air Grinder.

RESULTS: Bladed type motor of Rotor D-03 cut job time 20% because of its ability to deliver higher speed under load. Tool paid for itself in 8 weeks. Also, tool is lighter, more compact . . . easier to handle, more versatile. Full details in Bulletin 42A.

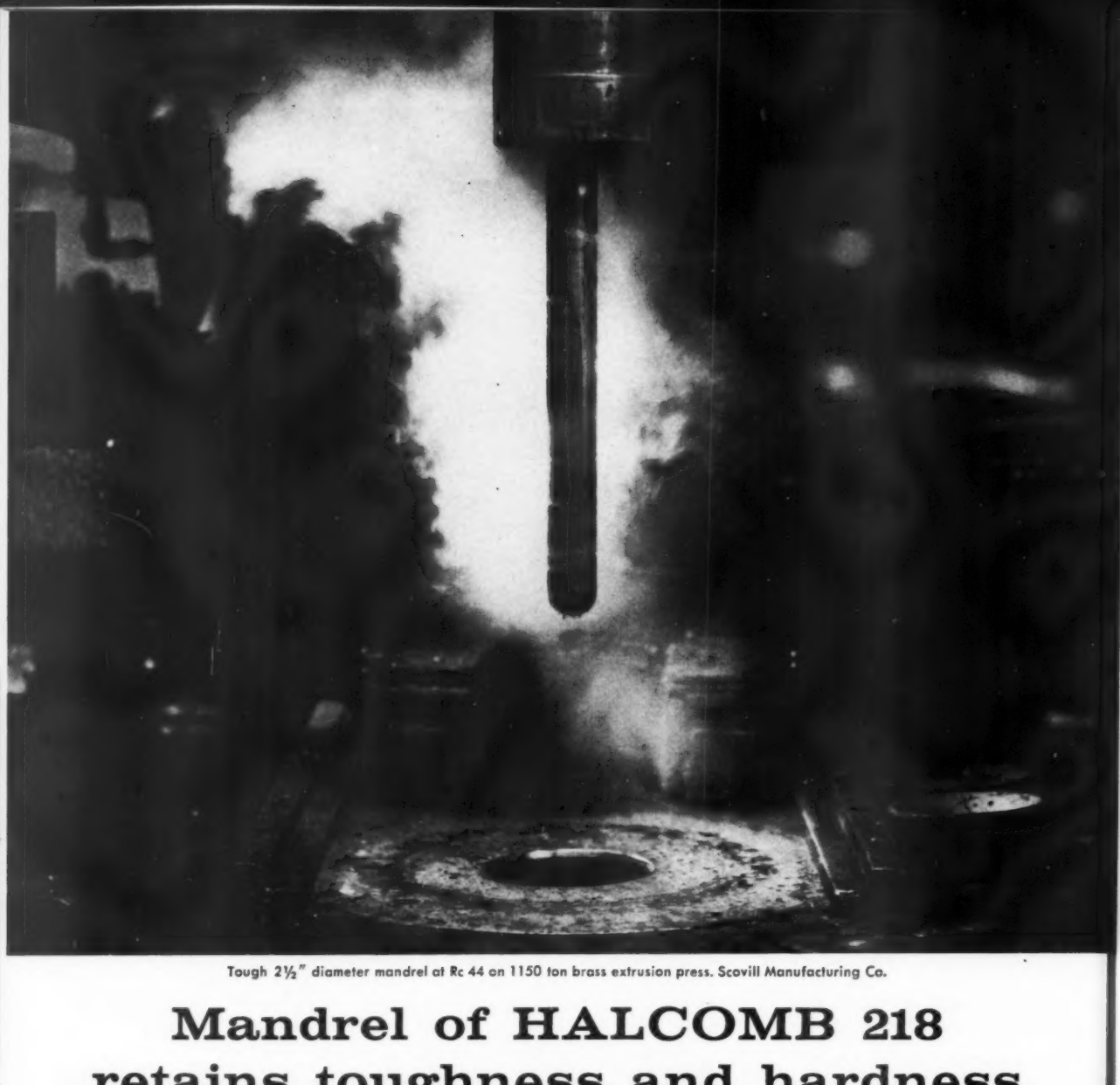
Have a Rotor Application Engineer study all of your portable tool operations for possible savings. No obligation.

ROTOR TOOLS
CLEVELAND, OHIO

Here's the RIGHT TOOL for YOUR job!

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

CIRCLE INFORM-A-GRAM KEY NO. 23



Tough 2½" diameter mandrel at Rc 44 on 1150 ton brass extrusion press. Scovill Manufacturing Co.

Mandrel of HALCOMB 218 retains toughness and hardness at hot work temperatures...

This mandrel is made of Halcomb 218—a tough, air-hardening hot work steel. Halcomb 218 is suitable for tools like this which require a higher degree of toughness at moderately elevated temperatures than is obtainable with the tungsten types of hot work steels. And Halcomb 218 *retains both* its hardness and strength at these temperatures.

For example, at a hardness of Rc 44, Halcomb 218's Charpy Impact Strength is 33 ft-lbs at 500F. And it will retain this hardness after 1 hour, after 10 hours and even after 100 hours at temperatures up to 900F.

Properties like these cut tooling costs. The mandrel shown above is good for 1200 pushes, for example, and even then all it needs, usually, is repolishing before being used again.

Halcomb 218 is particularly useful for all hot work operations on which drastic coolants are used. It even resists breaking very successfully when water cooled in operation. If these sound like advantages you can use, call your local Crucible representative for more complete data. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 24

. . . Month's Talk from page 22

phone Laboratories was in this case a key contribution, but many other developments — including high purity germanium and silicon, the semiconductor diode, and the proliferation of transistor types — have been contributed by other companies.

The new market created by semiconductors and related products thus benefits the sponsor and in our case well justifies our research and development expenditures in this field. However, the broad participation in the new market is a corollary benefit which accrues to many participants and is a particularly attractive opportunity for the small company, many of which have been born or have matured in this new market.

Policy of Buying Locally

A policy of being a good "community neighbor" allows a large plant to contribute to the business of other companies in the same area. General Electric's Appliance Control Department at Morrison, Illinois — a town of 4,000 people — buys from 1,400 firms, and 780 of these are within 150 miles of Morrison. In Rome, Georgia — a town of 35,000 — our Medium Transformer plant buys from 900 different companies, 540 of them nearby.

Our company as a whole spends about two billion dollars a year buying the goods and skills of 42,000 suppliers across the country. Some of these are big companies, furnishing us with complete transportation service or vast quantities of giant machinery, but 90% of them are small businesses offering the special skills we need.

There are many other ways in which large industrial research aids small business. Patents and the licensing of ideas generated in large laboratories give profit opportunities to thousands of businesses — and jobs to millions of men and women.

Two thirds of the research and development in America today is being undertaken by private industry — a major shift in the balance of research effort since the days a few decades ago when university laboratories and laboratories of individual scientists accounted for most of it. The National Science Foundation has observed that only 10% of small manufacturers (with less than 500 employees) have a research program, but nearly 95% of manufacturers with over 5,000 employees have a research program. The large companies, although they account for only 40% of manufacturing employ-

. . . *Continued on page 30*

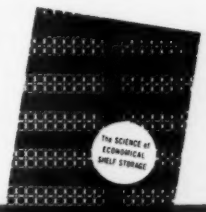
STORAGE PLANNED BY F-G-M
AVOIDS WASTED TIME, WASTED SPACE IN TOOL AND PARTS STOREROOMS

Fewer steps, shorter waits, because all items are close . . . within easy reach, without climbing.

Frequently needed small items at your fingertips with Rotabin Counter Unit.

Here's how to cut factory costs by cutting waiting time of machinists and other expensive help at the tool-room service counter . . . decrease downtime of machines while operators wait for tools.

Servicing time can be cut in half, tool crib capacity can be doubled with expertly planned use of F-G-M Rotabins and other Bonderized Steel Shelving. F-G-M Storage Planning by experienced Storage Engineers is a Frick-Gallagher Service that's yours for the asking.



Send for your free copy of Catalog 100-B, "The Science of Economical Shelf Storage." Write to Frick-Gallagher Mfg. Co., 106 S. Michigan Avenue, Wellston, Ohio.

FGM
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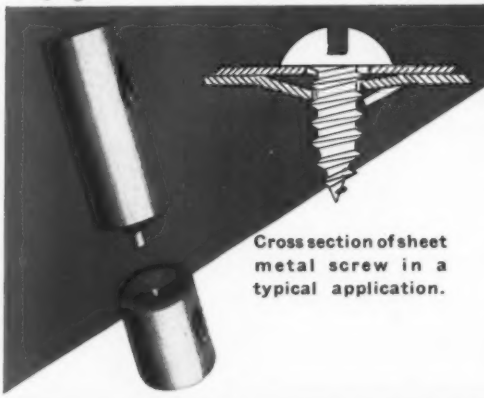
BONDERIZED
STEEL EQUIPMENT
FOR EVERY STORAGE NEED

ROTABINS | STEEL SHELVING | WAREHOUSE RACKS | COUNTERS | SPECIALTIES

CIRCLE INFORM-A-GRAM KEY NO. 25

Now! FOR EVERY TYPE OF FASTENER... R-B Punches and Die Buttons

THREAD-HOLE FORMING . . .



Cross section of sheet metal screw in a typical application.

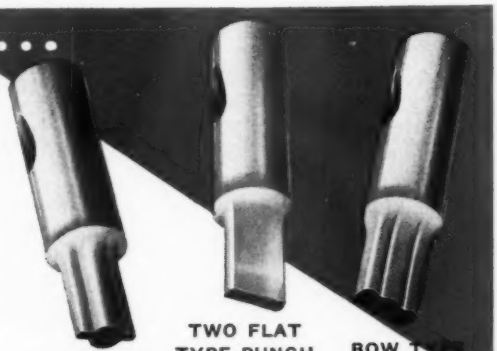
Cuts Assembly Time and Material Costs

With each stroke of the press, R-B Thread-Hole forming punches pierce a hole, lance a radial slit, and form surrounding metal into a spiral cone that conforms to the pitch of your sheet metal screw thread. By producing these formed-thread-holes directly in the sheet metal you eliminate the need for using nuts, washers, tap strips, etc. R-B formed-holes provide greater holding power against vibration, contraction, etc. R-B Thread-Hole Forming Punches and Die Buttons are carried in stock in several sizes.

FOR SIMMONS TYPE FASTENERS . . .

R-B Piercing Assures Low-Cost Holes

R-B manufactures a line of standard punches and die buttons that rapidly pierce exactly the type of holes required for Simmons spring-lock fasteners. Punches and die buttons have the standard R-B ball-lock feature which prevents vertical and radial movement in the retainer—assures accurate alignment without additional keying—permits quick insertion and removal. Carried in stock, these standardized punches and die buttons can be used in any conventional press.

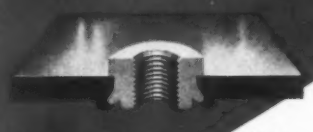


WING TYPE PUNCH

TWO FLAT TYPE PUNCH

BOW TYPE PUNCH

R-B CLINCH NUT TOOLING . . .



Cutaway showing how R-B tooling swages work piece as well as clinch nut. This produces a strong key which eliminates nut rotation.

Punch holds nut magnetically. Nut pierces hole and is clinched underneath by the die button.

Will Tighten Your Fastening Costs

R-B Clinch Nut Tooling permits you to insert and clinch one or more nuts with each stroke of the press—no extra clinching or welding is necessary. Also, the same die can pierce, form or blank your product. R-B furnishes standardized punches, die buttons, hoppers and flexible feed chutes for any size or shape Clinch Nuts.

Special R-B Punches and Die Buttons

R-B will design and manufacture special punches and die buttons that will economically pierce holes for any type of fastener—Use R-B Engineering Service For Your Piercing Problems.

RICHARD BROTHERS PUNCH DIVISION

ALLIED PRODUCTS CORPORATION

DEPT. 92 • 26476 CAPITOL AVENUE • DETROIT 39, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 26

Two COMPLETELY NEW *Hammond* UNITS that are making Grinding History!

The new Hammond Electrolytic *Oscillating* and Chip Breaker Grinders were designed primarily for use with the Anocut electrolytic grinding process. A controlled and precise method, the Electrolytic process removes stock electrochemically. It is *not* to be confused with electro-spark or electro-arc methods. It reduces diamond wheel consumption 80% to 90%.

Combined with electrolytic grinding, these Grinders provide a tremendous advance in grinding ease, speed and cost reduction.

WRITE FOR FREE LITERATURE

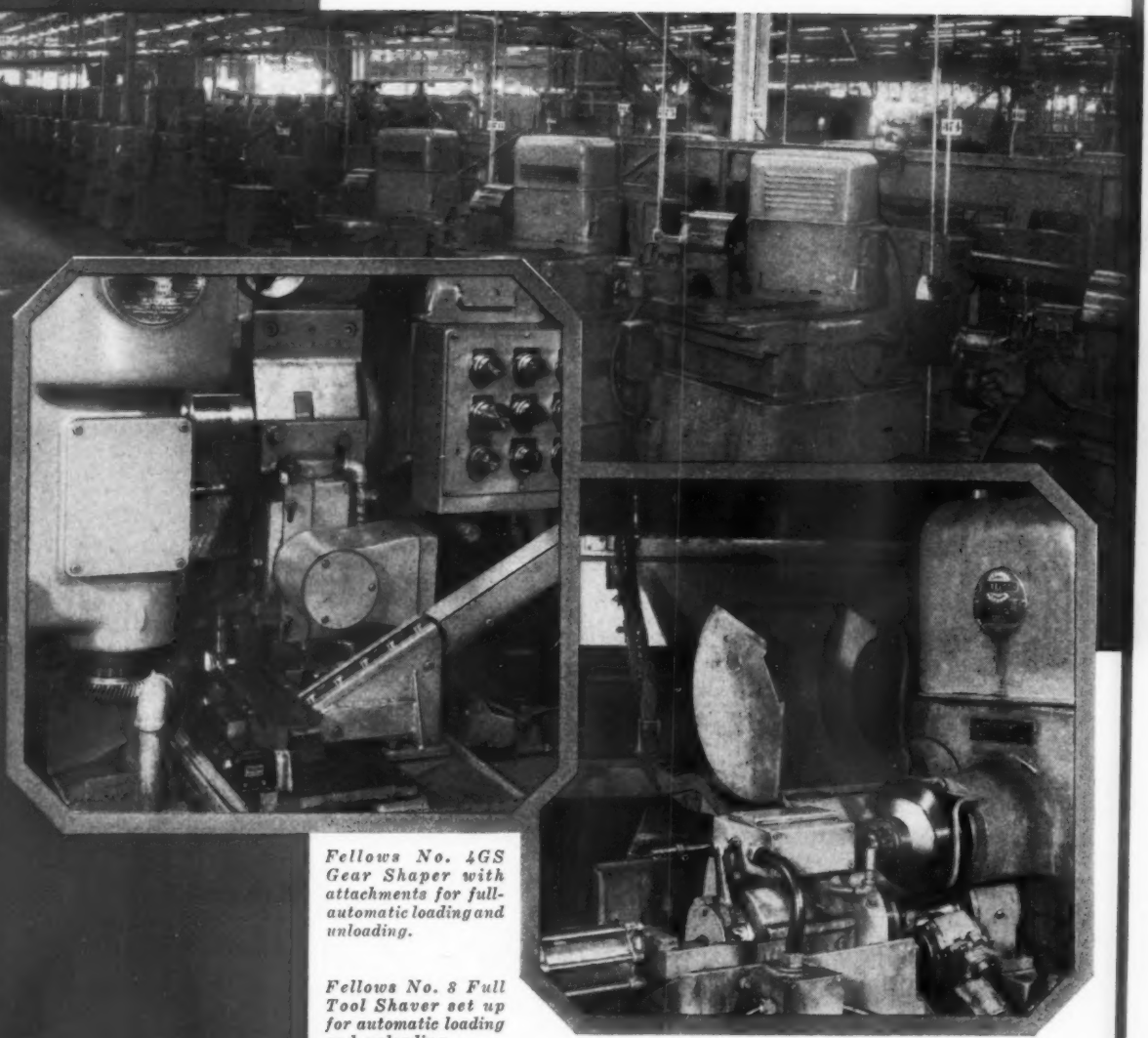
Hammond Machinery Builders INC.

1631 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

See us at the Plant Maintenance Show — Chicago Amphitheatre, Booth 1171, Jan. 27-30.

CIRCLE INFORM-A-GRAM KEY NO. 27

THE *FORWARD* LOOK . . .



Fellows No. 4GS Gear Shaper with attachments for full-automatic loading and unloading.

Fellows No. 8 Full Tool Shaver set up for automatic loading and unloading.

THE
PRECISION
LINE

in Chrysler's Fully-Automatic Gear Production Line

Fully-automatic shaping and shaving on Fellows machines: this is "*The Forward Look*" in gear production techniques, adding advanced speed and efficiency to pinion production for Chrysler Corporation automatic transmisions.

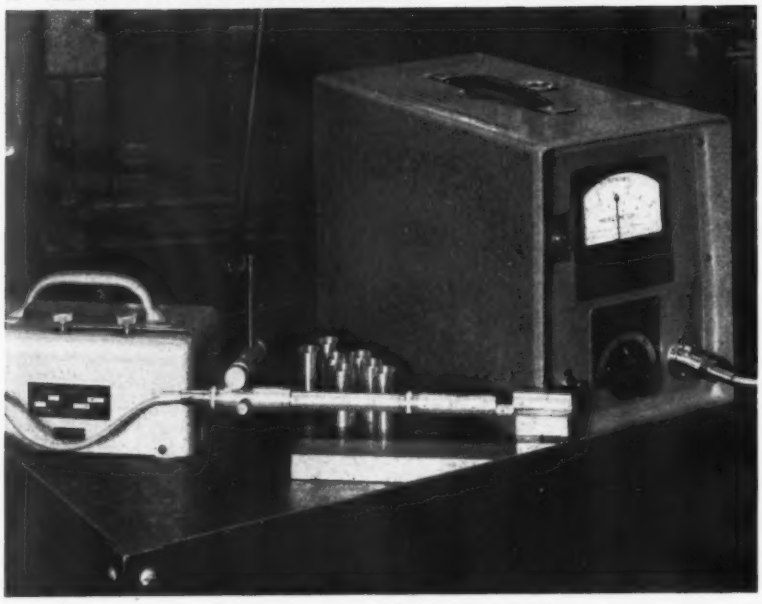
Cutting at a speed of 470 strokes per minute, each of 14 Fellows No. 4GS Gear Shapers rough cuts and finishes a 1.286" P. D. pinion in less than a minute. Parts are then automatically conveyed and loaded on Fellows No. 8 Full Tool Shavers for final finishing. Parts are automatically stock-piled in process to spread production evenly over machines.

These are the same versatile machines that many manufacturers use for manual production of short runs of gears and other shaped parts! Optional attachments provide any degree of automatic operation desired. Ask your Fellows Representative to show you facts and figures on the cost advantages of investment in modern Fellows machines. A 71-page booklet, "The No. 4GS Gear Shaper," describes and illustrates the machine in full detail, including attachments for automatic or semi-automatic operation. Write, wire, or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
150 West Pleasant Ave., Maywood, New Jersey
5835 West North Ave., Chicago 39, Illinois
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

PROFILOMETER® GROUP II



An Unusually Handy Combination for Dependable Roughness Measurement

THIS equipment will measure the microinch roughness of every surface that *needs* to be measured, in most plants — with *proven Profilometer accuracy.* It is lightweight and portable — built for use by shop men — and includes the following items:

AMPLIMETER — Shows all roughness measurements from 0 to 1000 microinches, on an easy-to-read meter. Factory-calibrated for dependability.

TYPE LJ TRACER — Measures on OD's as small as 1/8" — ID's as small as 1/4" — flats — tapers — narrow splines. Passes through a 3/4" hole.

MOTOTRACE AND LINKARM — Give the Tracer a *steady support* and *smooth motion,* essential to dependable measurement. No operator skill required.

FREE BULLETIN LT17 gives details. Write for it! ● And, without obligation, let us arrange for a demonstration in your plant. We have representatives in principal industrial centers throughout the Free World.

You can DEPEND on the PROFILOMETER — first in surface roughness measurement since 1936.

Profilometer is a registered trade-mark.

MMC® MICROMETRICAL MANUFACTURING COMPANY

339 S. MAIN ST. ANN ARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 30

. . . Month's Talk from page 25

ment, do 72% of all industrial research and development.

A Common Pool of Science

All scientific progress is based on published scientific knowledge assembled from sources throughout the world — "world science." Thus all scientists and nearly all of their sponsors feel an obligation to contribute to the pool from which so much sustenance is drawn. Most industries today recognize the reciprocal advantages of prompt publication of research results.

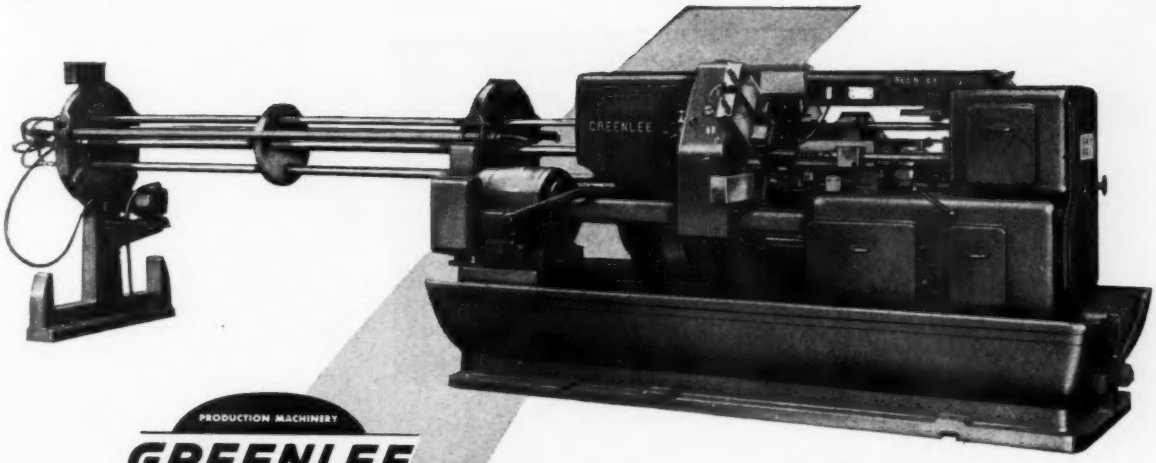
Scientists and engineers at our company, for example, have published some 4,000 papers during the past 10 years. Large-scale industrial research also makes important contributions to the world of science through the participation of its representatives in technical meetings, by training personnel for scientific work in many places — including small business — and in countless informal ways.

The existence of the huge pool of knowledge that I have called the "world of science" offers great hope and great challenge to small business. Here is a foundation of "free" information on which to extend present technology and build innovations. Frankly, the principal cost of this information is the cost of learning how to understand and use it. Small business must make an investment in this world of science, if not by contributing to it, at least by participating in it, and at the very least, by keeping in touch with it and appraising its opportunities.

Problems of Small Business

Part of the research and development problem, as it affects the owner of a small business, is that many such owners do not recognize that research and development is one of their major problems. A survey made specially for this conference showed that most people in small business believe that finance is their most important current problem. Small business itself views research and development as a lesser problem than finance, personnel, and sales, but representatives of large businesses interviewed in the same survey, generally placed research and development as the primary problem facing small business, ranking it above personnel, finance, and sales. Thus it is not surprising that the financial and tax advisor is commonplace in the operation of small business. And it also follows that, as a representative of large industry, I would like to emphasize the impor-

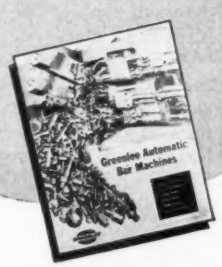
. . . *Continued on page 32*



PRODUCTION MACHINERY
GREENLEE

AIR-FEED AUTOMATIC

1. **Permits Greater Job Versatility**
2. **Easily Adapted to Multiple Feedouts**
3. **Provides Longer Stock Feedout**
4. **Eliminates Stock Scoring**
5. **Reduces Stock Reel Noise**
6. **Eliminates Stock Pushers**
7. **Eliminates Feedout Cams**



Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY
GREENLEE

2041 MASON AVE.
Rockford, Illinois

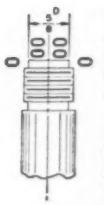
CIRCLE INFORM-A-GRAM KEY NO. 31

The Lepel line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

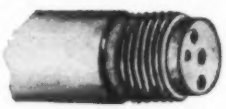
If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

TYPICAL INDUCTION HEATING APPLICATIONS

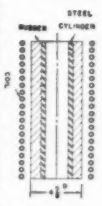
HARDENING
DIESEL FUEL INJECTOR



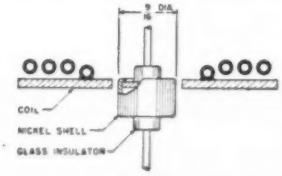
Restriction of heat to end of holder body for fuel injector permits hardening of face to provide required resistance to deformation without hardening the threads. Coil design shown provides uniform temperature for hardening despite holes in face.



REMOVING
RUBBER FROM STEEL



Induction heating develops uniform temperature at steel-rubber interface destroying bond for easy separation. Steel and rubber may similarly be salvaged from mounting brackets, shock absorbers, etc.

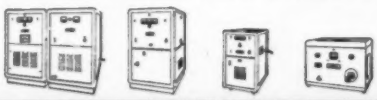


SOLDERING TRANSISTOR ASSEMBLIES

Concentrator-type coil creates high intensity, restricted heating at joint of nickel shell and tinned glass, thus causing solder flow for permanent seal.

Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 32

. . . Month's Talk from page 30

tance to small business of becoming expert in keeping up with modern technology. The cup of research opportunity truly runneth over, and there is nourishment for all, large and small, who will take the initiative to go after it.

What Small Businesses Can Do

"Going after it" admittedly is easier to say than to do. For the small business there are several available methods of tapping the world of science, methods that have proved highly useful to various small companies under varying circumstances. Where its technological needs are limited to a well-defined area of science, the small business should consider having its own scientific staff.

Even a one-man staff, with the right man trained in the right area, can make a significant contribution through its own work, by keeping up with the pertinent technical literature, and by attending and interpreting the important work being presented at technical meetings and conferences. Where its technical needs are in several well-defined areas of science, and where there is a degree of coherence between them, a small business can consider creating a suitable research staff.

Alternatively, the small company may employ part-time technical and scientific consultants from competent nearby colleges, and may supplement such consultation by actual project research work on a contract basis. Industrial research institutes provide a particularly good opportunity for the small company to contract for its research program or supplement one already in place.

And, of course, there is the technical know-how which one business can get directly from another business. Large companies that sell materials can make available — and want to make available — extensive scientific knowledge about the application of these materials. Large companies which buy parts and services from small companies can make available — and want to make available — technical help, scientific advice, and value-analysis programs that will be good business for both buyer and seller.

We may as well face up to reality and admit that many times these sources of technical know-how go tragically unused because the "mutual help" aspects are misunderstood and so-called "pride" keeps human beings from asking for technical ad-

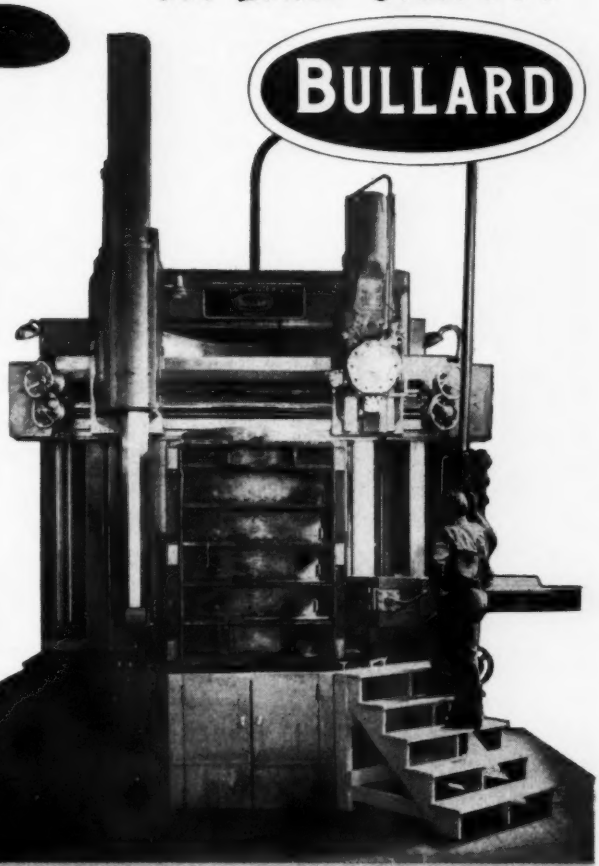
. . . *Continued on page 36*

are You interested in PROFIT DEVELOPMENT

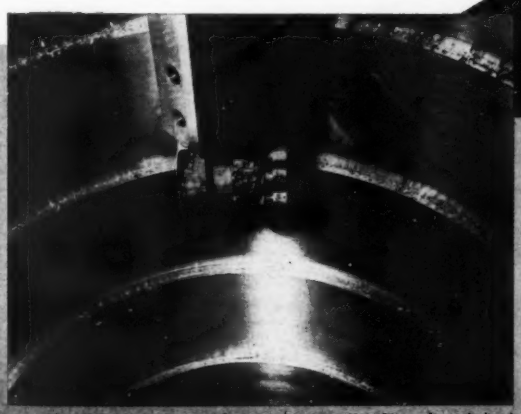
through reduced machining time and Lower Costs . . .

The new 66" Bullard Cut Master, Model 75 purchased by E.D. Jones & Sons Co., Pittsfield, Mass., has reduced from 65 to 48 hours the machining time required for a 4,000 lb. stainless steel piece used in a paper-making machine.

The Bullard Cut Master V.T.L., Model 75 line offers many features and advantages to help you — cut costs when cutting metal.



The part, 68" high, formerly had to be machined in three operations. Now, with an extension on the 62" Ram, a table speed of 9.6 r.p.m., feed of .0208 and ⅛" depth of cut, it is possible to machine the entire depth in one operation.



Close-up showing step boring and facing operation with 370 grade carboloy tool.

Complete details are available from your nearest Bullard Sales Office or Distributor or write

THE BULLARD COMPANY

BRIDGEPORT 9, CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 33

Announcing Webber

SQUARE GAGE BLOCKS

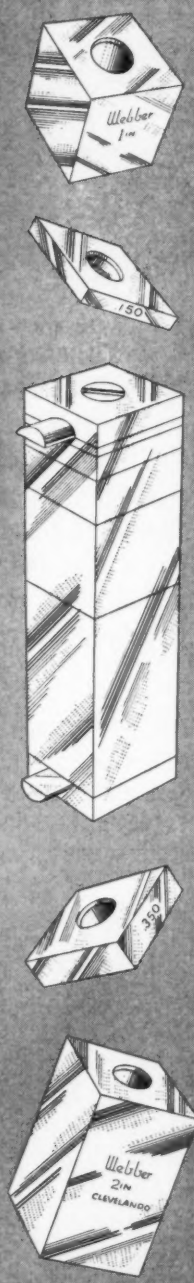
in Steel and Croblox

Webber Gage Company, ***pioneers in the development of Chrome Carbide Gage Blocks,*** proudly announce the availability of **SQUARE** Gage Blocks both in standard steel and Croblox (solid chrome carbide).

Catalog and prices available upon request.

Webber **GAGE COMPANY**
12903 Triskett Rd., Cleveland 11, Ohio

Set No. 88A w/accessories plus one pair .100 and one pair .050 Croblox wear blocks.



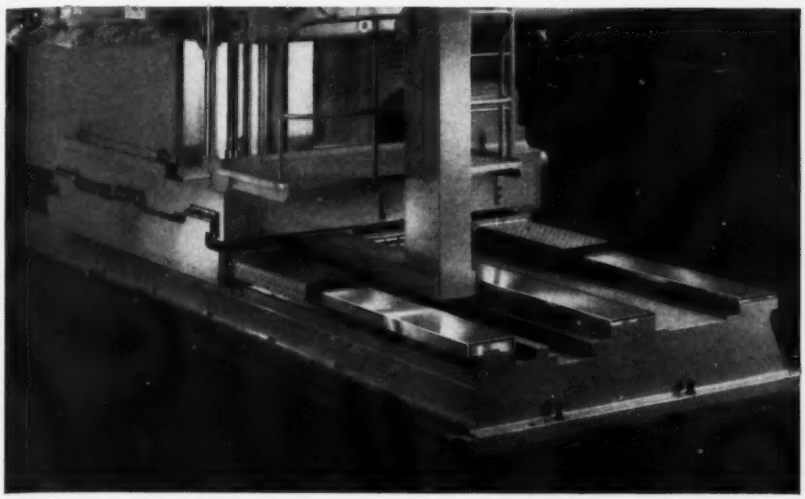
LARGEST EXCLUSIVE MANUFACTURERS OF PRECISION GAGE BLOCKS

CIRCLE INFORM-A-GRAM KEY NO. 34

O-KNI-CO MACHINE TOOL news

PRODUCTION FACTS THAT INCREASE YOUR PROFITS

PUBLISHED BY THE OHIO KNIFE CO., CINCINNATI, OHIO



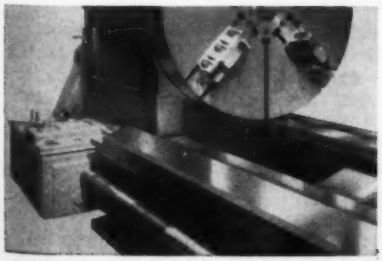
O-KNI-CO hardened bedways, cross ways on new GRAY 650 FC horizontal boring machine.

Big machine tool builders solve wear and accuracy problems with quality O-KNI-CO processed hardened ways and wear plates

The G. A. Gray Co., The Niles Tool Works of the Baldwin-Lima-Hamilton Corp., The Gisholt Machine Co. are among the many users of O-KNI-CO products.

By a time proven process, special analysis tool steel of any thickness is eternally bonded to a soft, tough, easily machinable steel, producing a superior way that will not warp or bow. Special O-KNI-CO hardening process (65-66 Rockwell C) to the full depth of the tool steel, along entire length of the way, develops amazing wear-resistant qualities.

Ordinary ways of one type steel, are usually heat treated by flame hardening, carburizing, or some similar process. This results in variations of depth and quality of hardness along the length of the way. The degree of hardness is usually well below the minimum standard (63 Rockwell C), necessary to eliminate galling, scoring and excessive wear. These conditions destroy the accuracy of the machine almost from the first day of operation, requiring continuous compensations in positioning of work.



O-KNI-CO processed hardened ways on 60 inch lathe made by The Niles Tool Works.

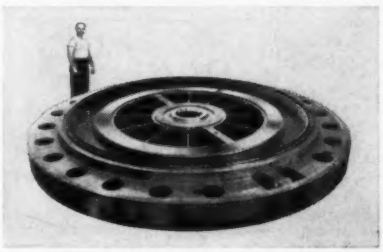
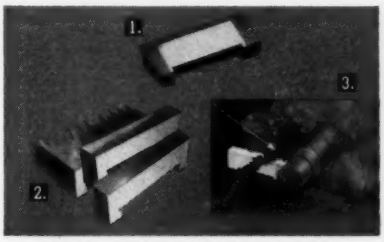


Table of Niles 20 foot vertical boring mill, inverted to show O-KNI-CO wear plates.

O-KNI-CO processed hardened ways are carried in stock in a variety of sizes and shapes, or made to suit your specific requirements. They are a perfect mating surface for either metal or non-metallic bearing surfaces. O-KNI-CO processed clad aluminum bronze wear plates are made by the same process and are available in standard stock sizes for quick delivery.

Gisholt Machine Co. gives amazing demonstration to prospective lathe buyers

Prospective lathe buyers witnessed an amazing demonstration of OK Bedway hardness at The Gisholt Machine Co., Madison, Wisconsin. Gisholt uses OK Ways exclusively on their ram and saddle



turret lathes, and to prove their quality they (1) took a section from an OK Bedway, (2) made it into a tool bit, (3) locked it in a fixture and cut spiral shavings from 1045 cold-rolled steel.

Ohio Knife Co., big supplier of shear blades to equipment builders

Special O-KNI-CO heat treating techniques applied to shear blades give maximum toughness and superb edge holding qualities. Various grades are available for shearing. OK Battle Axe blades shear up to ¼" mild steel, OK Dura-chrome blades for shearing hot or cold plate up to 1¼" and OK Utility blades for short runs and heavy plate.

FREE technical literature available. Check off—mail coupon today.

THE OHIO KNIFE CO., Dept. 66-LL

Cincinnati 23, Ohio

Gentlemen: Please send me free copy of:

- ☐ HARDENED WAYS—Seven Cross Sections in over 60 sizes.
- ☐ SHEAR BLADES.
- ☐ SLITTING—A Basic Guide for the New Operator.

NAME_____

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ADDRESS_____

CITY_____ STATE_____

7520

. . . Month's Talk from page 32

vice. There are normal and established business channels through which businesses — large and small — can help each other. These channels are not being used to the fullest. In many cases, a businessman needing technical assistance could get it by calling the technical service representative of a materials supplier or the appropriate purchasing agent of a large-company customer.

Effect on National Security

No discussion of the benefits of large-scale research and development would be complete without a reference to what this effort means to our national security. In these times, when national security depends increasingly on advanced scientific and productive capacity and versatility, all industry continues to have a deeply important public responsibility to participate in the national defense program.

Ralph J. Cordiner, president of General Electric, has summarized the national defense picture in these words: "Today's defense challenges are of such complexity that they require marshalling the full range of American business enterprise. Large companies with extensive technical skills and resources must provide over-all coordination of complex projects which they can do best, while at the same time creating opportunities for the thousands of smaller or more specialized companies to contribute what they can do best."

Requirements for Future Progress

A variety of forces and circumstances however, are limiting — even endangering — our nation's technological progress. We should consider seven specific things that need to be done to insure the continuation of the benefits of large-scale industrial research. They are at least as important to small business as they are to large business.

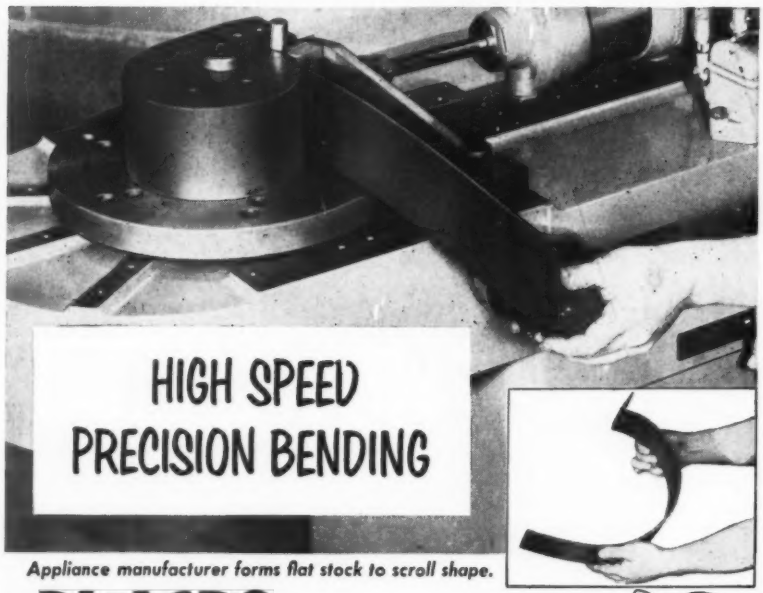
1. To insure continuation of the benefits of research, we must build up the nation's supply of adequate technical manpower. Engineers and scientists obviously hold the key to our nation's progress in this swift-moving age. Industry, large and small, can do much to solve the shortage of technically trained people.

2. To insure continuation of the benefits of research — particularly the benefits to small business — we must rejuvenate our patent system. There is need for a more sympathetic attitude on the part of the courts toward the original concepts and philosophy upon which the patent system is based. We must recognize that the inventor who provides previously unknown ideas, machines, and processes definitely contributes to the progress of our social structure. There also is need for improving the facilities of the United States Patent Office for determining whether the inventions submitted for patenting are new or old. It is apparent that the Patent Office, in common with other components of our technical society, threatens to be overwhelmed by its inability to accumulate, classify, and search — as its responsibilities require — the growing mass of technical literature, including its own, within a reasonable time.

3. We must develop new ideas about scientific advances and how they are produced. We need greater understanding of scientific and technical specialization and their relationship to team effort. We must recognize, in developing our management concepts, the basic character of creative technical work, and must provide the incentives which stimulate productive effort.

4. We must create a better understanding among our citizens of the

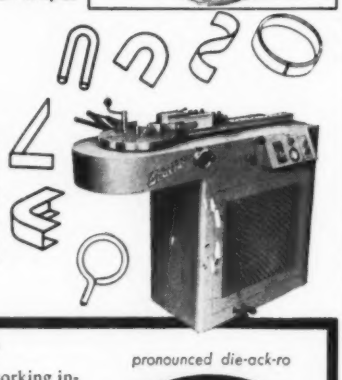
. . . Continued on page 39



Appliance manufacturer forms flat stock to scroll shape.

DI-ACRO HYDRA POWER BENDER

Simple and complex bends are being formed at low cost in daily production across the nation with hydraulically operated Di-Acro Benders. The Bender can be delivered completely tooled by the factory for bending tubing, moulding, extrusions and special materials. For a free production estimate, send a dimensional sketch and sample material for your component.



SEND FOR "IT'S EASY TO BEND"

Thirty-six pages of valuable metal working information for anyone with bending problems. It's a "how to" book covering many materials and shapes. No charge—write today.

pronounced die-ack-ro

di-acro PRECISION METALWORKING MACHINES

O'NEIL-IRWIN MFG. CO., 315 8th Ave., Lake City, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 36

EDLUND

Edlund 2F Drilling Machine in use at Pratt & Whitney Co. West Hartford, Conn., drilling, reaming and tapping precision parts.

Edlund Model 2F Drilling Machines at PRATT & WHITNEY

Pratt & Whitney, famous manufacturer of machine tools — Jig Borers, Keller Machines, Gages and Cutting Tools, uses Edlund Drilling Machines to assist in the production of precision parts.

Modern features —
Flexibility of infinitely variable speeds • Rugged construction for sustained accuracy typical of Edlund; • No Loss of Production Time Changing Belts or Gears.

For complete information and specifications about Edlund Model 2F Drilling Machines for your jobs, write for Bulletin 140R.

Production Line of
Edlund 2F Drilling Machines
at Pratt & Whitney featuring—

- Power Table Lift
- Extra Spindle Travel
- Reversing Motor Tapper

EDLUND REPRESENTATIVES IN MAJOR CITIES

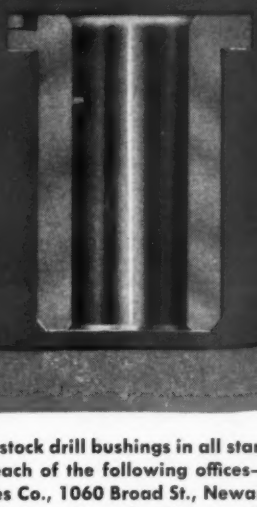
EDLUND
MACHINERY COMPANY
Cortland, New York
Division of Harsco Corporation

you get close tolerance drilling with

UNIVERSAL DRILL BUSHINGS

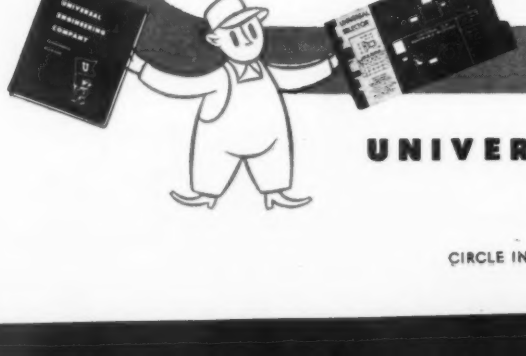
Accurately machined bushings are essential when drilling to close tolerance. UNIVERSAL DRILL BUSHINGS, of finest quality steel, are carefully tested for 100% concentricity and hardness, assuring pin-point accuracy and uniform quality. To prevent tool hang-up and breakage, each bushing has a blended radius on the top inside diameter.

All bores are superfinished. This superfinishing of bushings is important, especially in close tolerance work, because it reduces both tool and bushing wear to a minimum. Knurled head gives a quick, sure grip.



We stock drill bushings in all standard sizes and lengths at each of the following offices—Universal Engineering Sales Co., 1060 Broad St., Newark 2, New Jersey; 5035 Sixth Ave., Kenosha, Wis., and at our home office in Frankenmuth. Contact the nearest office for immediate delivery.

The Universal Drill Bushing Slide Chart gives accurate engineering data for the selection of all types and sizes of drill jig bushings up to 1¾" drill size. You may have one—free—by requesting on your company letterhead. At the same time, get your copy of our new catalog that describes all of UNIVERSAL'S products including chucks, tool holders, boring bars, bushings and index plungers.



UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 8, MICHIGAN

207

CIRCLE INFORM-A-GRAM KEY NO. 38

. . . Month's Talk from page 36

necessary relationship between profit and progress. It is unrealistic to assume that the research activity of private industry can be geared to the demands of technological progress without consideration of adequate profits. Adequate profits give us the opportunity to maintain the cycle of technological progress: research — new products— jobs — sales — and the profits that permit the cycle to start again. We must reaffirm to people everywhere the basic American belief that profit, instead of being something "left over", is an integral element of the growth of our nation and our society.

5. We must create a greater understanding, principally on the part of management and employees, of the significance of new processes and new products. The human trait of "resistance to change" has kept people in some parts of the world literally in the dark ages. Even in America, individual unwillingness to accept the temporary "inconvenience" associated with innovation is a major deterrent to insuring our defense and improving our living standards. Obviously, I am not suggesting that everything that is new is necessarily good, nor that all of the results of modern scientific research will yield immediate improvements in our products or our way of living. However, it is essential that we all contribute to an atmosphere in which new things can be evaluated objectively, without fear of changes simply because they are changes.

6. We must continue to urge that a greater proportion of the nation's total research effort be done by industry — large and small — and that the government's research be administered in a way that stimulates the progress, vitality, and independence of business. Even in the national defense area, private industry would be willing and able to finance a greater proportion of the needed research and development — if the procurement policies were to provide the same profit incentives that over the years have been so magnificently productive in the civilian economy.

7. We must establish a climate of informed public opinion which recognizes the political and economic conditions necessary for encouraging the expansion of industrial technology.

The opportunities presented by today's "technological revolution" are so challenging that America needs the full range of her industrial resources, large and small, each company doing what it can do best, and each drawing strength from the other.

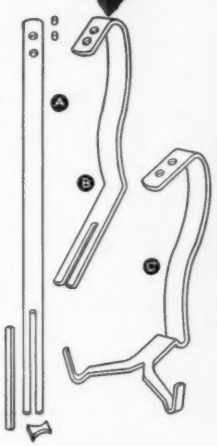
top performance IN MASS PRODUCTION

60 vaporizer stands per minute . . . automatically formed in one operation on an A. H. Nilson combination press and 4-slide. Kaz Vaporizer stands are a proof that clever product design, combined with precision tooling by Nilson, increases production and lowers costs.

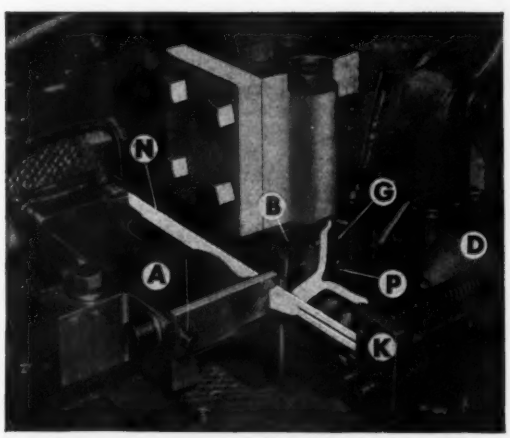
NILSON 4-SLIDES FEATURE—

- ONE-MAN OPERATION
- FORMING OF WIRE OR RIBBON METALS FROM THE COIL
- ONE FAST, AUTOMATIC OPERATION WHICH STRAIGHTENS, FEEDS, PIERCES, BLANKS, SWAGES, STAMPS OR COINS, CUTS OFF, FORMS
- CRITICAL TOLERANCES UP TO .002 ON ANY RUNS
- FAST TOOL AND DIE CHANGING
- WIDE SIZE RANGE—FORMS WIRE UP TO ½ IN. DIA. IN FEEDS TO 32 IN. MAX. AND RIBBON STOCK UP TO 3½ IN. WIDE
- PRESS SECTIONS—5 TO 30 TON CAP.
- HEAVY DUTY MODELS—50 AND 75 TON CAP.

Without obligation, Nilson provides specific forming recommendations from detailed information. Send for A. H. Nilson catalogue . . . the first step to increased production.



Stand is zinc-plated steel strip 0.05 in. thick by 0.625 in. wide . . . made in steps A, B and C.



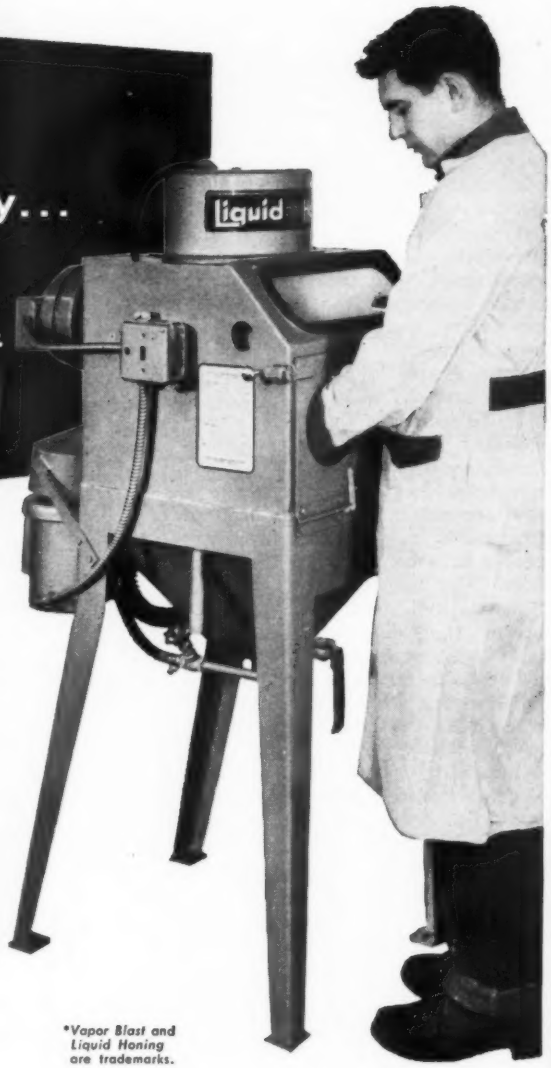
Final step in forming Kaz stands on Nilson 4-slide. Feet are spread, bent, crimped (G) with workpiece (P) on centerpost while next piece (N) is being cut off. Stop (K) on right slide (D) backs off after cut and workpiece (P) is wrapped around centerpost by die (A) when finished part is clear.

THE A. H. NILSON MACHINE CO.
1503 Bridgeport Ave., Shelton, Conn.

NILSON

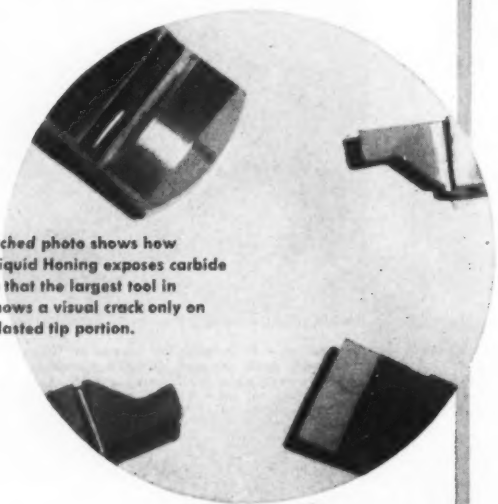
CIRCLE INFORM-A-GRAM KEY NO. 39

Detect Carbide Cracks Quickly, Positively... with V-B Liquid Honing*



Now you can prevent profit losses traceable to new or reground carbide tools that break because of cracks, porosity and other imperfections. Liquid-abrasive action flushes out the fine sintered material which, under grinding heat and pressure, often seals minute cracks and prevents detection by other methods. After Liquid Honing, fissures and other defects become *visually apparent* in a satin matte finish that remains dimensionally the same as the previous finish. Liquid Honing inspection processing is fast and thorough — more than 100 single-point tools per hour. And those tools, if not defective, last longer and cut better because they're free of burrs.

*Vapor Blast and Liquid Honing are trademarks.



This unretouched photo shows how effectively Liquid Honing exposes carbide cracks. Note that the largest tool in the group shows a visual crack only on the Vapor Blasted tip portion.

A Liquid Honing machine for carbide crack detection serves you in many other ways. Use it for surface conditioning, finishing, cleaning or descaling — often at production savings of 65% to 80%!

Write for complete information on case histories and low cost — only $550 to $1500 for a standard machine. And send a sample tool or part for free demonstration processing.

VAPOR V-B BLAST
MILWAUKEE, WISCONSIN

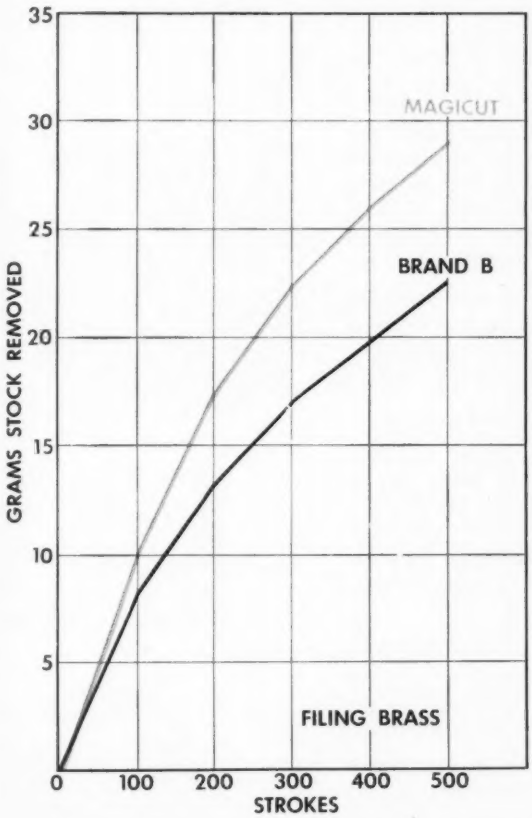
VAPOR BLAST MFG. CO.
3131 W. Atkinson Ave. • Milwaukee 16, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 40

Laboratory report:

New "Magicut" file outperforms other types by wide margins on varied industrial metals

Only way to prove what the new Nicholson or Black Diamond "Magicut" All-purpose Machinist's file will do for you is to try it in your plant.



But we've conducted some laboratory tests. Results of these will give you an idea of the savings you can expect with this unique new file. We compared "Magicut" with all kinds of Machinist's files—old and new, ours and others. (Of course these were *hand* tests.)

In just one part of these trials—comparing our new file with another described as being similar in purpose—we found these percentage superiorities for "Magicut": 28.8% over Brand "B" on brass (shown in chart) ... 24.7% on aluminum ... 16.2% on magnesium ... 15.4% on .70 carbon steel ... and 11.4% on copper. *And these figures have been confirmed in the field.*

There's not another file that can cut your metal filing costs like the Nicholson or Black Diamond "Magicut" can. Because not another file has the "Magicut's" Penetrating Planer-type Teeth. These rough and smooth industrial metals in a single stroke. You need fewer files —fewer strokes per job.

"Magicut" is the cost-cuttingest file you can use. Available right now in Flat, Half Round and Square shapes ... 8", 10", 12" and 14" lengths. See and try "Magicut" soon.

FREE! Complete reports of "Magicut" laboratory findings. Send for this authoritative guide to lower filing costs.

Industrial Distributors provide the finest goods and services in the least possible time. Our files are sold exclusively through them.

"Magicut's" perfectly formed gullets eliminate "pinning" and consequent scratching. Note steep-angled serrations which produce maximum cutting surfaces.

NICHOLSON U.S.A. **NICHOLSON FILE COMPANY, PROVIDENCE 1, RHODE ISLAND** BLACK DIAMOND U.S.A.

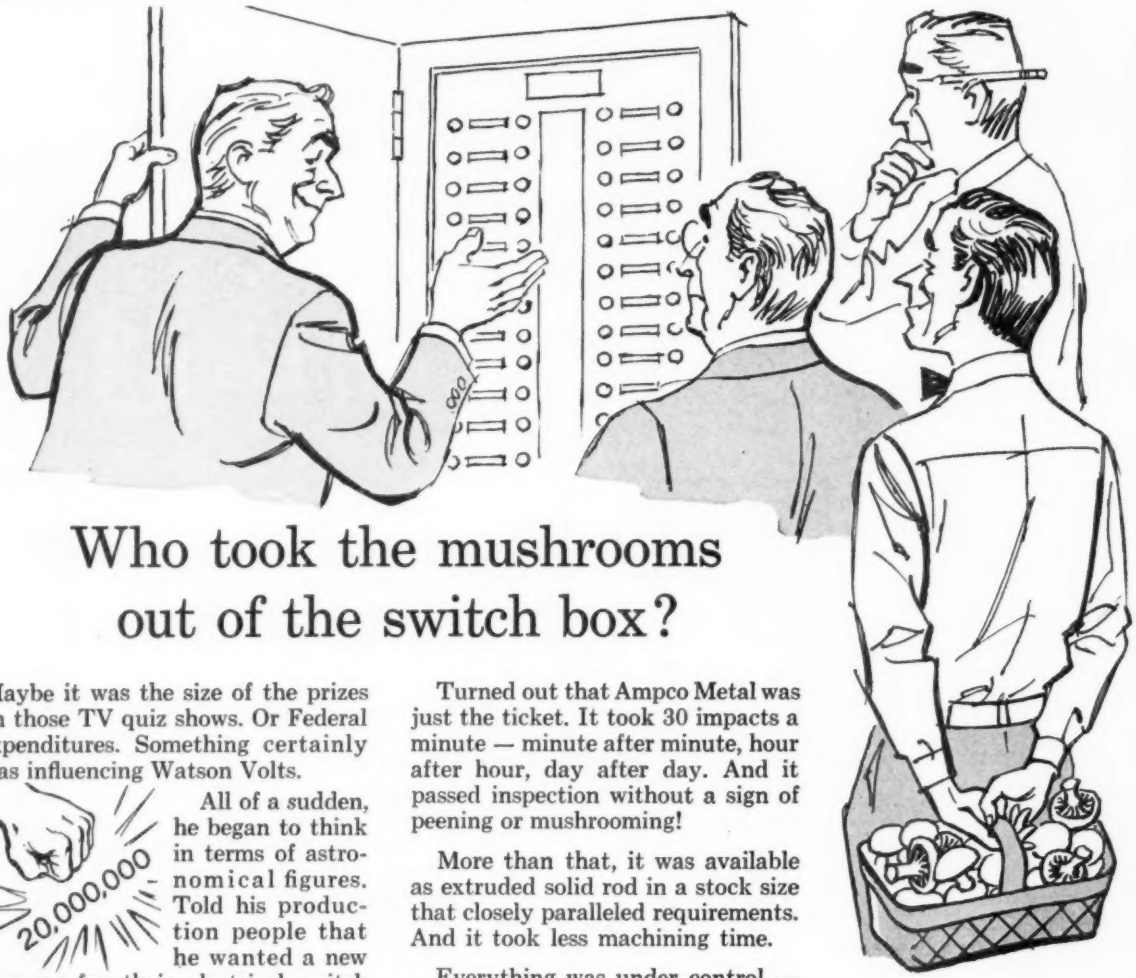
(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON and BLACK DIAMOND FILES

A FILE FOR EVERY PURPOSE

CIRCLE INFORM-A-GRAM KEY NO. 41

Any similarity to a real-life company is purely intentional



Who took the mushrooms out of the switch box?

Maybe it was the size of the prizes on those TV quiz shows. Or Federal expenditures. Something certainly was influencing Watson Volts.

All of a sudden, he began to think in terms of astronomical figures. Told his production people that he wanted a new bumper for their electrical switch box. One that would take 20,000,000 (yep, that's right — twenty million) impacts! And do it without appreciable wear!

Like the hermit who saw a giraffe for the first time, the production manager said, "There ain't no such animal!" Suspecting, of course, that he'd eventually find that there was. Which he did.

Somewhere along the line, A Samaritan told the p.m. about Ampco Metal. About how it is a whole series of uniform-quality copper-base alloys engineered to meet a wide range of special-duty requirements.

Turned out that Ampco Metal was just the ticket. It took 30 impacts a minute — minute after minute, hour after hour, day after day. And it passed inspection without a sign of peening or mushrooming!

More than that, it was available as extruded solid rod in a stock size that closely paralleled requirements. And it took less machining time.

Everything was under control — including costs!

Ampco Metal extruded solid rounds combine high strength and hardness with exceptional resistance to wear, fatigue, and corrosion.

Companies in many fields regularly use extruded solid rods of Ampco Metal — for bearings, bushings, worms, gears, and other vital parts.

Your Ampco stocking distributor can supply diameters from ⅛" to 5⅜". Call him for prompt service. If you don't know who he is, write us for his name. *Ampco Metal, Inc., Dept. TP-1, Milwaukee 46, Wis. (West Coast Plant: Burbank, Calif.)*

AMPCO® METAL

The metal without an equal

RM-7

There IS a Big Difference in Saw Blade

Try DoALL *CLAW-TOOTH* on Your Next Job!

How the CLAW-TOOTH blade reduces contour or cut-off *sawing costs* . . .

CUTS ALL MATERIALS—Steel, titanium, brass, iron, asbestos, plastics, wood, rubber and many other metals and non-metallics.

EXTRA FAST CUTTING—The claw-like, positive rake angle teeth literally "pull themselves" into the work—providing more penetrating power and smoother chip flow.

EXTRA LONG LIFE—Made sharp to *stay* sharp—scientifically designed tooth and gullet shape gives you longer blade life. Teeth are securely anchored to the flexible back to take heavy cutting loads without breakage.

EXTRA EASY CUTTING—Its "bite-in" cutting efficiency requires less feed pressure, resulting in more output with less work per operator.

ACCURACY OF SET ± .002"—Only DoALL *guarantees* this set accuracy. It means you get straight, accurate cutting of virtually any material . . . freedom from binding . . . ability to produce a predetermined kerf size and surface finish.

CLEAN, BURRLESS CUTTING—Means less finishing and grinding costs.

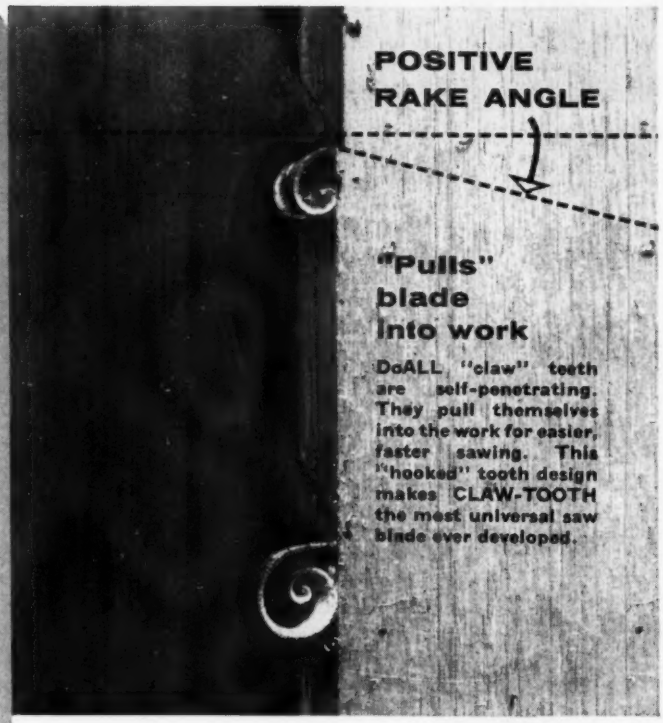
GUARANTEED UNCONDITIONALLY—to be completely free of defects in material, workmanship, heat treating and packaging.

Convenient "strip-out" Containers —

100′ or 500′ coils in exclusive DoALL "strip-out" boxes for convenience, safety and blade protection.

Custom Welded Lengths —

to fit any band sawing machine. Individual packages or cartons of six packaged blades.


POSITIVE RAKE ANGLE
"Pulls" blade into work
DoALL "claw" teeth are self-penetrating. They pull themselves into the work for easier, faster sawing. This "hooked" tooth design makes CLAW-TOOTH the most universal saw blade ever developed.

Available in CARBON or HIGH-SPEED STEEL

They'll saw faster on any machine!

There's a DoALL saw band for every machine and job . . . but the blade that handles *more* jobs *better* is the CLAW-TOOTH! For cut-off jobs or contour sawing, the versatile CLAW-TOOTH blade can reduce both your sawing costs and blade inventory.

Available in ¼" to 1" blade width—2, 3, 4, and 6-pitch. For lowest cost per square inch of cutting, specify DoALL CLAW-TOOTH. Or, if you have a special sawing problem, ask about DoALL's free blade selection service—complete recommendations will be furnished for your job.

Call DoALL locally for details, or send for FREE catalog listing complete line of DoALL band tools.

SB-58

Find Your DoALL Store In The 'Yellow Pages'

DoALL

THE DoALL COMPANY, Des Plaines, Illinois

THIS IS A TYPICAL DoALL STORE

Call Your DoALL Service-Store

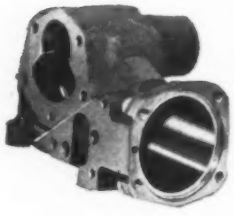
MACHINE TOOLS ..... CUTTING TOOLS ..... MEASURING INSTRUMENTS ..... SHOP SUPPLIES IN STOCK

CIRCLE INFORM-A-GRAM KEY NO. 43

Why MICROHONING

Is Final Stock Removal Process For Interrupted and Blind-End Bores

To secure low-cost, final stock removal, that generates accuracy and functional surface characteristics in a variety of bore conditions, a leading manufacturer of power steering assemblies uses Microhoning. Here are details concerning types of bores and stock removal results obtained by using Micromatic "Know How"—



STEERING GEAR HOUSING—Microhoning consistently corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—cuts boring tool sharpenings—lowers down-time and tool costs.

Material: Soft Malleable Iron
Bore: 3.125"D x 6.93"L (Ported bore with ¼" relief at blind end)
Stock Removal: .002"
Finish: 50 Microinches RMS
Microhoning Cycle: 18 sec.
Preceding Operation: Boring

PISTON RACK—Microhoning answers the need for a final stock removal process that generates a controlled surface finish in the bore of this leaded steel part. Microhoned surface (cross hatch) prevents oil leakage and holds to a minimum the wear of seal that operates in the bore.

Material: Leaded Steel (Rockwell 62 "C")
Bore: .875"D x 3"L
Stock Removal: .005"
Finish: 20 Microinches RMS
Microhoning Cycle: 20 sec.
Preceding Operation: Boring and H.T.

VALVE HOUSING—Microhoning consistently holds size and geometric accuracy—meets stringent surface requirements—assures alignment of four lands in bore. Thus, there is no leakage of oil around control valve which is selectively fitted to its housing.

Material: Cast Iron
Bore: .770"D x 2.18"L (Interrupted)
Stock Removal: .0025"
Tolerances: Size .0005"
Roundness .0001"
Straightness .0001"
Finish: 10 Microinches RMS
Microhoning Cycle: 12 sec.
Preceding Operation: Boring

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on_____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME_____G
TITLE_____
COMPANY_____
STREET_____
CITY_____ ZONE_____ STATE_____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 44

MATERIALS HANDLING EQUIPMENT, by D. Oliphant Haynes. Published by Chilton Book Division, Philadelphia 39, Pa., 1957. 636 pages, $17.50.

It has been said that perhaps some 50 tons of materials are moved for every ton of finished product turned out. Material handling, then, is an important field for which to consider time and money-saving methods. This book, the story of material handling machines and systems, gives readers a total perspective that can enable them to spot key areas to watch, overall systems to compare, new equipment to consider, and a fundamental basis from which to plan their own operations.

Topics included in the basic text include types of equipment and their capabilities, unit-load handling, in-process handling, integration of production machinery with handling equipment, package handling, techniques for analyzing specific problems, analysis and design of handling systems, cost analysis, and organization and control of handling systems. Over 2,200 illustrations help make the book even more valuable.

WORK SIMPLIFICATION, by Gerald Nadler. Published by McGraw-Hill Book Co., Inc., 330 W. 42 St., New York 36, N. Y., 1957. 292 pages, $6.50.

This book concentrates on the techniques of work simplification and how they are used, rather than why the methods work or other background facts. It tells how to analyze and improve manual work methods to increase productivity, reduce fatigue, eliminate danger, and save materials. Techniques are clearly described and applications are illustrated for a variety of types of work. Chapter organization is directly related to each step in the scientific approach for solving problems, and emphasis is placed on the human being. Many recent advances in the work simplification field are included, such as a finer detailed breakdown and photographic illustration of new Therblig charts; predetermined times for fine detailed Therbligs; a description of UNOPSR, an electronic device for measuring operator motions; and a list of revised process and operation chart symbols.

WELDING HANDBOOK, Fourth Edition, Section One, edited by Arthur L. Phillips. Published by American Welding Society, 33 W. 39th St., New York 18, N. Y., 1957. 560 pages, $9.

The Welding Handbook, starting with this volume, is now being divided into five sections, with one section to be published each year for the next five years. This, the American Welding Society believes, is the only method by which the handbook can be kept reasonably up-to-date.

The first section, now available, deals with the fundamentals of welding: standard welding terms, basic welding metallurgy, design, inspection, statistical control, etc. A comprehensive bibliography is included at the end of each chapter for those seeking further information on a given subject.

STATISTICAL ABSTRACT OF THE UNITED STATES, 1957. Published by the Bureau of the Census, Department of Commerce, 1957. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., or from Commerce Department Field Service Offices. 1,061 pages, $3.50.

This latest edition of Uncle Sam's "answer book" marks the 78th successive year that the government has published the Statistical Abstract. Over 1,000 up-to-date tables and charts are in it, covering subjects ranging from population and work force to iron consumption and state tax figures. This year, facts and figures summarizing America's atomic energy activities are a new feature.

THE HANDBOOK OF POWERED INDUSTRIAL TRUCKS. Published by the Industrial Truck Association, Ninth & F Sts., Washington 4, D. C., 1957. 94 pages, $5.

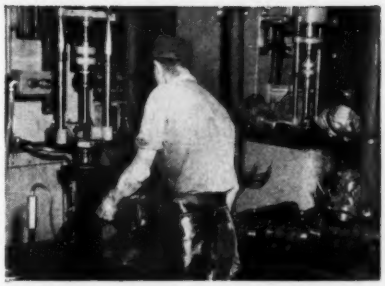
This plastic-bound manual of all types of powered industrial trucks is the result of more than two years of combined effort by various association committees. Divided into five sections — applications, cost savings through industrial truck handling, planning for and selection of trucks, truck engineering data, and industrial trucks and the future—it should be of value to operating, production, maintenance, material handling, and purchasing personnel.

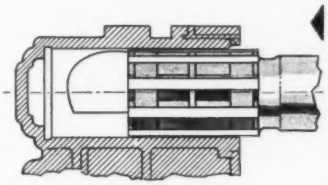
Numerous case studies point out specific industrial truck applications, and nearly 200 illustrations show different type trucks, attachments, containers, and load carrying devices.

How MICROHONING

Cuts Costs—Generates Accuracy—Speeds Production of Interrupted, Blind-End Bores

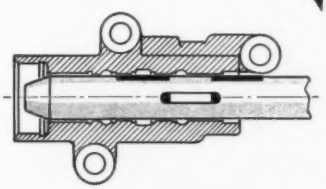
Shown are two Microhoning machines that are used in the plant of a leading manufacturer of automotive power steering assemblies. Machines are equipped with automatic stone feed and stonewear compensating mechanisms, and automatic sizing controls. A two-position rotary fixture is interlocked with machine controls for fully automatic index cycle. The following applications tell more of the "how".





STEERING GEAR HOUSING—In Microhoning the ported, blind-end bore of steering gear housing a nine-stone tool is used. At least six of nine stones are in contact with bore surface when tool passes over irregularly shaped port. Removing .002" of stock from 3.125"D x 6.93"L bore in 18 seconds, Microhoning generates final accuracies and a controlled finish of 50 microinches as specified.

PISTON RACK—In 20 seconds, Microhoning removes .005" of stock from .875"D x 3"L open end leaded steel bore of piston rack. Self-sharpening abrasives assure a consistent generation of specified surface finish of 20 microinches.



VALVE HOUSING—Microhoning tool used for final stock removal in bore of valve housing has one bank of stones and two banks of plastic guides—three stones or guides in each bank. Guides act as tool pilots and stabilizers in interrupted bore—prevent overcutting at edges of lands—assure straight bore by keeping tool aligned. Self-dressing abrasives consistently generate geometric accuracy of .0001" and surface finish of 10 microinches.

Microhoning economically removes stock—corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—lowers machine tool downtime and maintenance to cut costs and speed production.

Send Coupon for Complete Information

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

PRECISION PRODUCTION THROUGH MICROHONING
MICRO MATIC

NAME_____G

TITLE_____

COMPANY_____

STREET_____

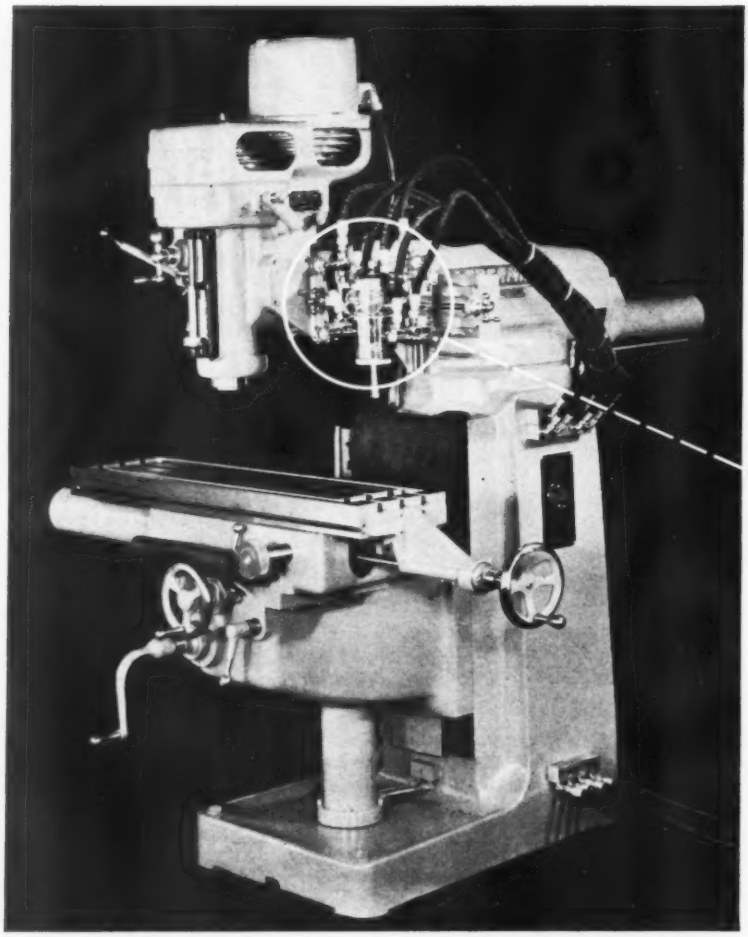
CITY_____ZONE_____STATE_____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 45

Now "Micrometer Accuracy" Applied to Hydraulic Tracer Control

Provides more speed in Production Profiling and Duplicating



Gorton Trace-Master Hydraulic Tracer control is today's best unit for 2- and 3-dimensional duplication, production profiling and work on all types of die forging, die casting, metal stamping, embossing and coining, as well as plastic molds in both ferrous and non-ferrous materials.

GORTON

"TRACE MASTER" Supersensitive Hydraulic Control

This master control valve is manufactured to tolerances which are NEW in the field of hydraulics. Working parts are so delicately ground and lapped that they will operate only with a very fine grade of special oil. *Ordinary hydraulic fluids are wholly unsuitable.*

3 MODELS AVAILABLE

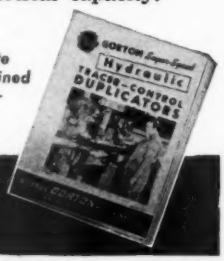
180° Vertical Hydraulic Feed to Knee.

360° Cross Hydraulic Feed to Ram and Longitudinal Hydraulic Feed to Table.

3D Hydraulic feed to knee, ram and table for 3-dimensional work.

The above can be furnished with the Gorton 1-22 Mastermil illustrated here or the Gorton 9-J Super-Speed Vertical Mill with single spindle, twin spindles and/or six inch higher column for additional vertical capacity.

Write for complete information contained in bulletin 2771—1201.



GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

1201 RACINE ST. • RACINE, WISCONSIN

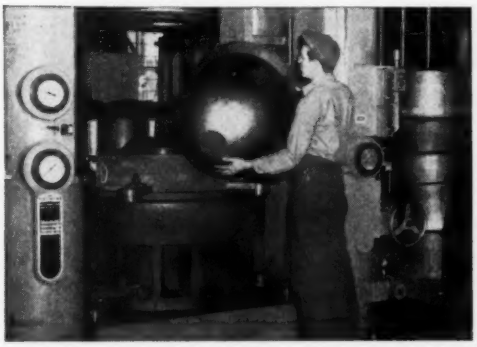
Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A7-1002-1P

CIRCLE INFORM-A-GRAM KEY NO. 46

H-P-M 1000-ton FASTRAVERSE sheet metal drawing press equipped with a 300-ton die cushion and 400-ton blankholder.

50% REDUCTIONS CUT DRAWING COSTS



"We're Very Pleased With Our H-P-Ms"

Mr. Homer F. Folk, Manager of Pressed Steel Department at A. C. F. Industries, Milton, Pa., reports, "We need an all-around versatile press and our H-P-M can be easily and quickly set-up and regulated for each specific draw job. The accurate control of drawing speed plus total elimination of high impact stresses guarantees proper metal flow and is one of the important factors in making reductions of 50% in one operation possible."

The H-P-M FASTRAVERSE press is infinitely adjustable for a multitude of drawing requirements. Independent control of each hydraulic action provides just the right tonnage for each job. Investigate these versatile all-hydraulic production units. Draw your sheet metal hydraulically. Write today for complete information.

H622

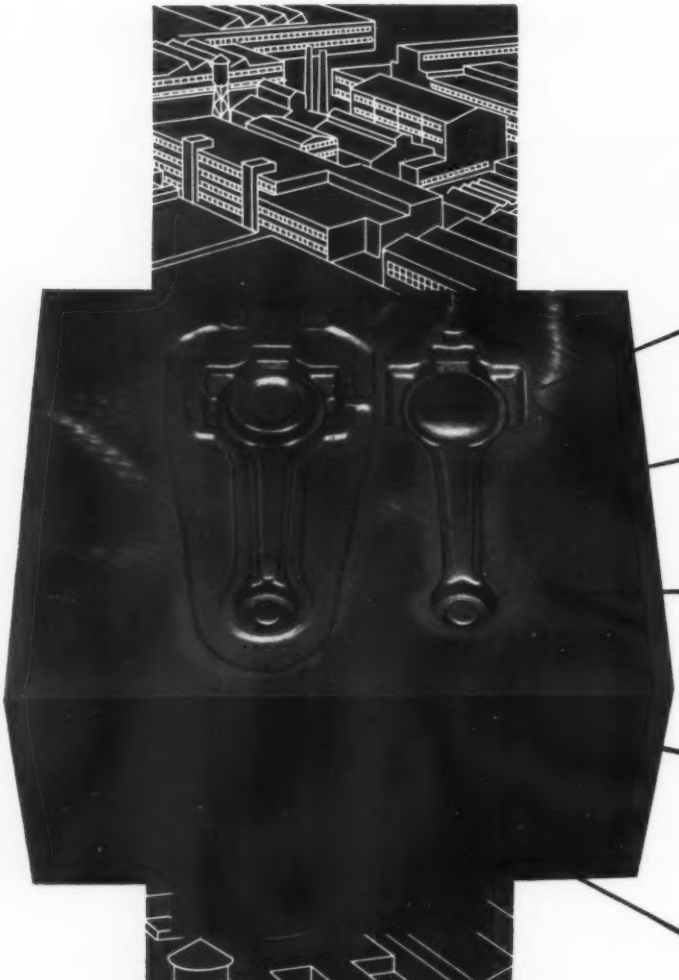
THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U.S.A.

HPM

CIRCLE INFORM-A-GRAM KEY NO. 47

...somewhere this forging die is making history!



Both halves of the die were Eloxed in only 50 hours.

Elox equipment used to create the impression costs less than half of conventional tooling equipment.

After washout, Elox equipment will have it back in service in seven hours.

In our Pre-purchase Evaluation division we will demonstrate how Elox can machine the cavities in your closed impression dies at 75% of your present cost. Write or phone today.

10" Connecting Rod Forging
Max. depth impression: 5/8"
Min. depth impression: 1/16"
Tolerances: + or − .003"

elox* *corporation of michigan*

* T. M. Reg.

1834 N. Stevenson Highway • Royal Oak 3, Michigan

ELOX keeps you ahead of competition • All forms of Die Making • Form Grinding and Tool Sharpening

For details on how EDM machining of cavity type dies can prove profitable for you, write for Bulletin P7-1257

CIRCLE INFORM-A-GRAM KEY NO. 48

There's a good reason why CHICAGO socket screws "roll with the punch"

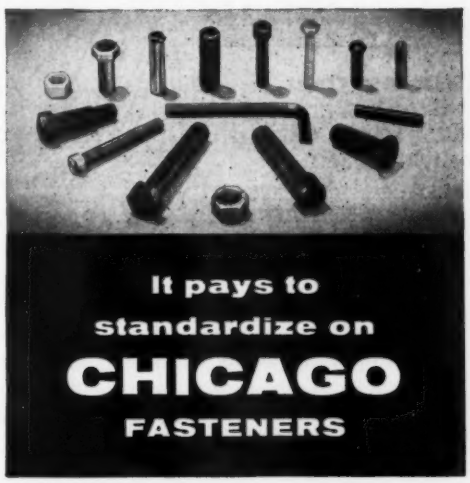
Strange as it seems, the hardest fastener or one with greater tensile strength can be the weakest part of your product. Why? Because excessive hardness results in a brittle fastener that is more susceptible to failure under sudden shock.

At CHICAGO, *proper* hardness is a mighty important phase of our metallurgical quality control. Through years of specialized experience, we've found the hardness range that produces a fastener with just the *right* amount of elasticity to withstand severe shock and vibration. Constant testing assures *every* fastener has this hardness . . . one of many reasons CHICAGO screws are the most dependable you can buy.

For help on all your fastener problems, call your CHICAGO distributor. He's your direct line to 85 years of fastener experience.

THE CHICAGO SCREW COMPANY

ESTABLISHED 1872 • DIVISION OF STANDARD SCREW COMPANY
2701 WASHINGTON BOULEVARD, BELLWOOD, ILLINOIS



CIRCLE INFORM-A-GRAM KEY NO. 49

Behind the scenes of

ANOTHER FIRST

from KEARNEY & TRECKER

It's the ultimate in drive transfer methods for maintaining perfect synchronization of exclusive twin-elevating screws on TF Series knee-type milling machines. Pace-making design offers maximum accuracy far beyond previous heavy duty knee-type designs.

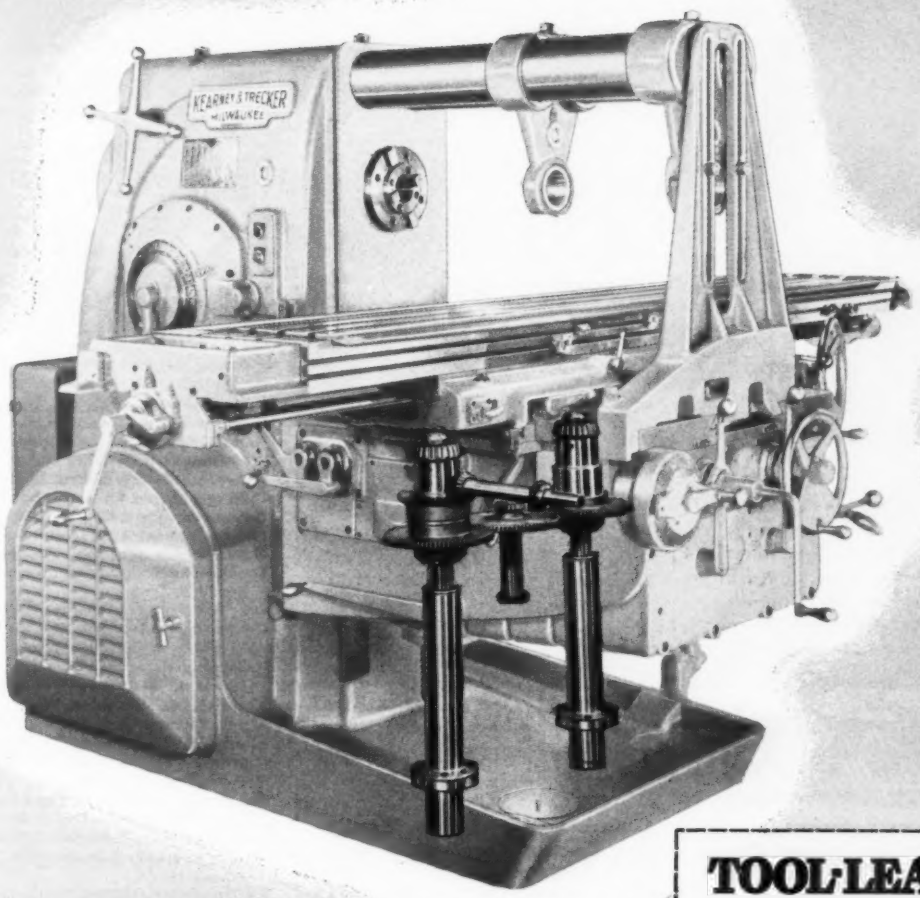
IT DIDN'T JUST HAPPEN! More than 7 years of research and evaluation of all basic methods of drive transfer were analyzed by dozens of Kearney & Trecker engineer-specialists, all for the sake of perfecting *this most practical design system* for driving twin-elevating screws.

ONE BY ONE, VARIOUS DRIVE METHODS WERE ELIMINATED!

Helical, bevel, herringbone gears, worm and wheel and chain drives... all were rejected for one or more reasons ... cost, complicated design and resulting maintenance difficulties, lack of consistent accuracy, excess wear and heat generation problems.

FINALLY, SIMPLE, COMPACT, SPUR PLATE GEAR DRIVE PROVES BEST! Optimum 3-gear system with wide center distance between screws gives maximum support to knee. Large gears allow more teeth... reduce error. Screws rotate in same direction, make it possible to match them accurately... no differential error between screws.

# of a very important development



TOOL-LEASE

Should you desire, you can conserve capital, reduce obsolescence using Kearney & Trecker Tool Lease program. It applies to all TF Series milling machines with exclusive twin-screw knee support as well as other Kearney & Trecker machine tools.

Write for complete Tool Lease program.

Hundreds of users know...
TWIN ELEVATING SCREWS REDUCE DEFLECTION AND INCREASE ACCURACY 3 TIMES...
over heavy duty single screw design milling machines.

FULL FACTS FREE!
Write for Bulletin TF-57 on your letterhead.

KEARNEY & TRECKER CORP.
6776 W. National Ave. • Milwaukee 14, Wisconsin

KEARNEY & TRECKER MILWAUKEE

Designers and Builders of Precision and Production Machine Tools Since 1898

CIRCLE INFORM-A-GRAM KEY NO. 57

Looking for

HARDNESS TESTING FACTS?

Get this *free* catalog

Catalog contains complete details on all types of Brinell Hardness Testers . . . for laboratory, or production: Dead Weight, Hydraulic, Hand or Motor Operated, Large or Small, Standard and Special.

Since 1914

Sales Offices in all metalworking areas.

Steel City Testing Machines Inc

8815 Lyndon Ave. Detroit 38, Mich.

Mail this coupon for above Brinell Catalog. Check interest below on other types of testing machines.

Ductility ☐ Tensile ☐ Compression ☐ Transverse ☐ Hydrostatic ☐ Proving Rings ☐ Flex-Tester ☐

NAME_____

ADDRESS_____

Attach coupon to your letterhead and mail.

CIRCLE INFORM-A-GRAM KEY NO. 52

GROWING PAINS

Westinghouse Electric Corporation has announced plans for the construction of a new plant at Glassport, Pa., for its manufacturing and repair division. The new plant will be used to service and repair electrical and mechanical apparatus of industries in the Tri-State area that includes Pittsburgh, Wheeling and Weirton, W. Va., and Steubenville, O. The building will house approximately 60,000 sq ft of space and will have a 100-ton crane capacity.

•

The Mardigian Corporation announces major expansion plans for its two Detroit area plants, including a new pattern shop and the building of a large new addition. This newly built 13,200 sq ft addition provides Mardigian a total area of over 170,000 sq ft, devoted exclusively to the production of tools, dies, and fixtures.

•

Flick-Reedy Corporation is building a new $2,300,000 plant near Bensenville, Ill. which is five times larger than present facilities in Melrose Park.

•

Construction of the new **Westinghouse Electric Corporation** multi-million-dollar power circuit breaker plant in Trafford, Pa., is scheduled to begin this year. The plant will have a total of 241,000 sq ft of manufacturing space.

•

Completion of a factory expansion program designed to provide new and larger floor space for assembly, electrical, and hydraulic departments is made known by **Snyder Tool & Engineering Company.** The expansion is the second stage of a planned program at the company's main assembly plant. The new 5,520 sq ft, $80,000 building addition will provide more high-bay floor space area for the assembly of automated machinery.

•

Capitol Products Corporation, aluminum fabricator, will construct a 70,000 sq ft plant near Sherman, Texas. This plant will serve a 10 state area.

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES

The American Laundry Machinery Co., Rochester, N. Y.
Atlas Foundry Co., Detroit, Mich.
Banner Iron Works, St. Louis, Mo.
Barnett Foundry & Machine Co., Irvington, N. J.
Blackmer Pump Co., Grand Rapids, Mich.
Bliss Co., E. W., Canton and Toledo, Ohio
Centrifugally Cast Products Div., The Shenango Furnace Co., Dover, Ohio
Compton Foundry, Compton, Calif.
Continental Gin Co., Birmingham, Ala.
The Cooper-Bessemer Corp., Mt. Vernon, Ohio and Grove City, Pa.
Crawford & Doherty Foundry Co., Portland, Ore.
Empire Pattern & Foundry Co., Tulsa, Okla.
Florence Pipe Foundry & Machine Co., Florence, N. J.
Fulton Foundry & Machines Co., Inc., Cleveland, Ohio
General Foundry & Mfg. Co., Flint, Mich.
Georgia Iron Works, Augusta, Ga.
Greenlee Foundries, Inc., Chicago, Ill.
The Hamilton Foundry & Machine Co., Hamilton, Ohio
Hardinge Company, Inc., New York, N. Y.
Hardinge Manufacturing Co., York, Pa.
Johnstone Foundries, Inc., Grove City, Pa.
Kanawha Manufacturing Co., Charleston, W. Va.
Koehring Co., Milwaukee, Wis.
Lincoln Foundry Corp., Los Angeles, Calif.
Nordberg Manufacturing Co., Milwaukee, Wis. and St. Louis, Mo.
Palmyra Foundry Co., Inc., Palmyra, N. J.
The Henry Perkins Co., Bridgewater, Mass.
Pohlman Foundry Co., Inc., Buffalo, N. Y.
The Prescott Co., Menominee, Michigan
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Sonith Industries, Inc., Indianapolis, Ind.
Standard Foundry Co., Worcester, Mass.
The Stearns-Roger Mfg. Co., Denver, Colo.
Valley Iron Works, Inc., St. Paul, Minn.
Vulcan Foundry Co., Oakland, Calif.
Washington Iron Works, Seattle, Wash.
Dorr-Oliver-Long, Ltd., Orillia, Ontario
Hartley Foundry Div., London Concrete Machinery Co., Ltd., Brantford, Ontario
Otis Elevator Co., Ltd., Hamilton, Ontario

CASTING DESIGN BOOK OFFERED.

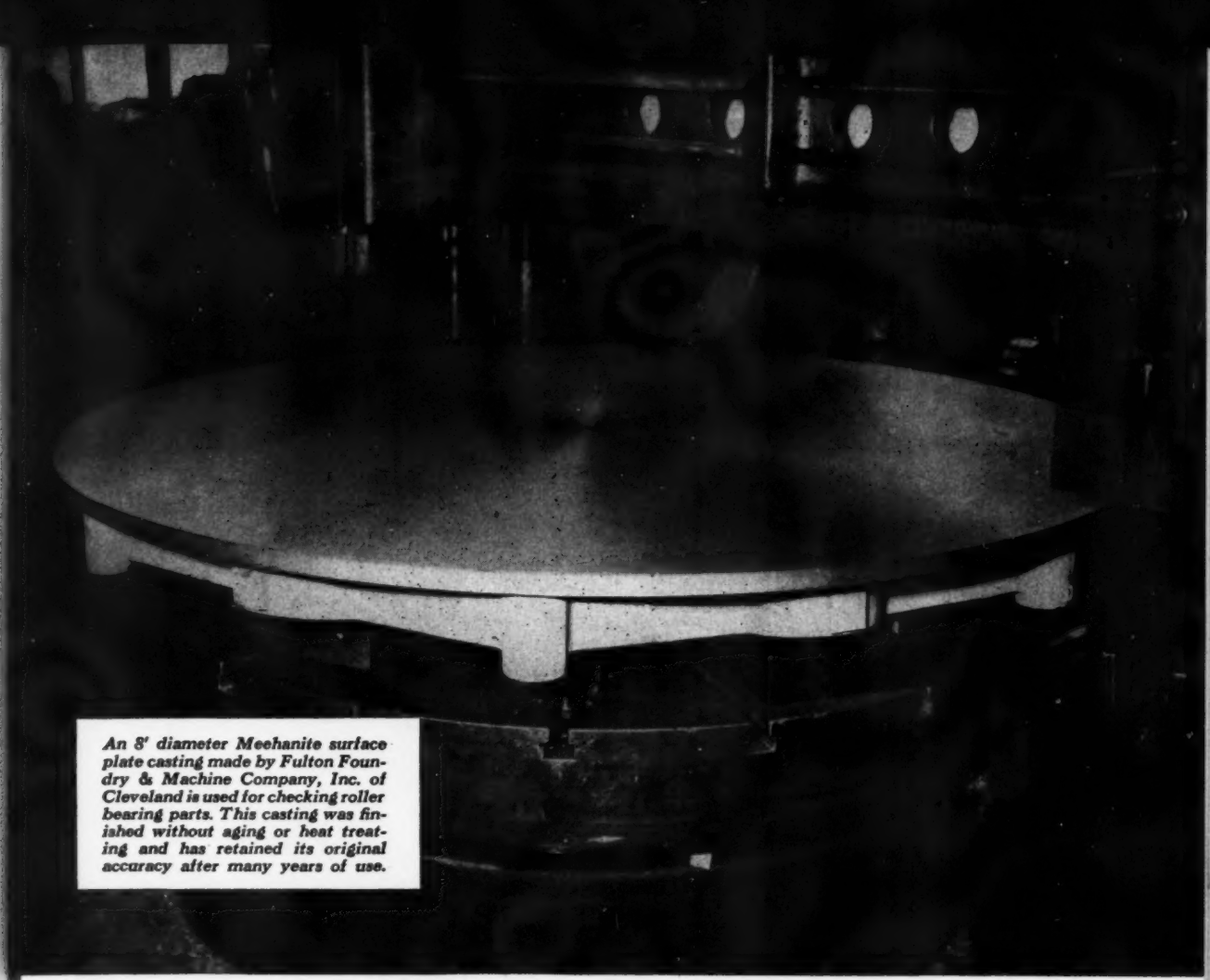
Send for your free single copy

Bulletin 44 — Contains 64 pages of helpful information on how to design sound castings.

Write today to Meehanite Metal Corporation, Dept. 8H, 714 North Avenue, New Rochelle, N. Y.

MEEHANITE®

CIRCLE INFORM-A-GRAM KEY NO. 53



An 8' diameter Meehanite surface plate casting made by Fulton Foundry & Machine Company, Inc. of Cleveland is used for checking roller bearing parts. This casting was finished without aging or heat treating and has retained its original accuracy after many years of use.

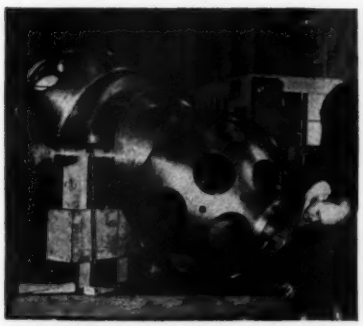
Meehanite castings maintain dimensional stability

Maintenance of accuracy of dimension is of first importance in modern engineering components. Meehanite metal has found wide favor with design engineers because it exhibits an unusually high degree of stability in the "as cast" and also in the hardened condition.

In addition to dimensional stability, the uniform solidity, greater strength, rigidity and shock resistance of Meehanite metal permits advantageous design changes and substantial reductions in casting weight.

Although structurally similar to high grade carbon tool steel, Meehanite metal contains graphite particles in controlled quantity and shape. This assures dense and uniformly solid castings regardless of weight or dimension.

If you have a question concerning the use of Meehanite® in your casting design, consult a Meehanite foundry and write today for your free single copy of "Casting Design As Influenced By Foundry Practice."



Meehanite® was selected in the construction of the Morrison Planetarium Projector because of its ability to maintain dimensional stability. These castings were made by Vulcan Foundry Company of Oakland, California.

MEEHANITE BRIDGES THE GAP BETWEEN CAST IRON AND STEEL®

MEEHANITE METAL

MEEHANITE METAL CORPORATION, NEW ROCHELLE, NEW YORK

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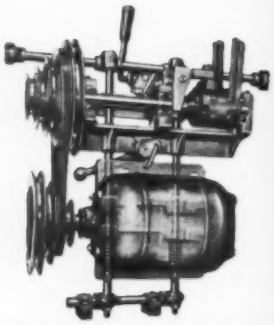
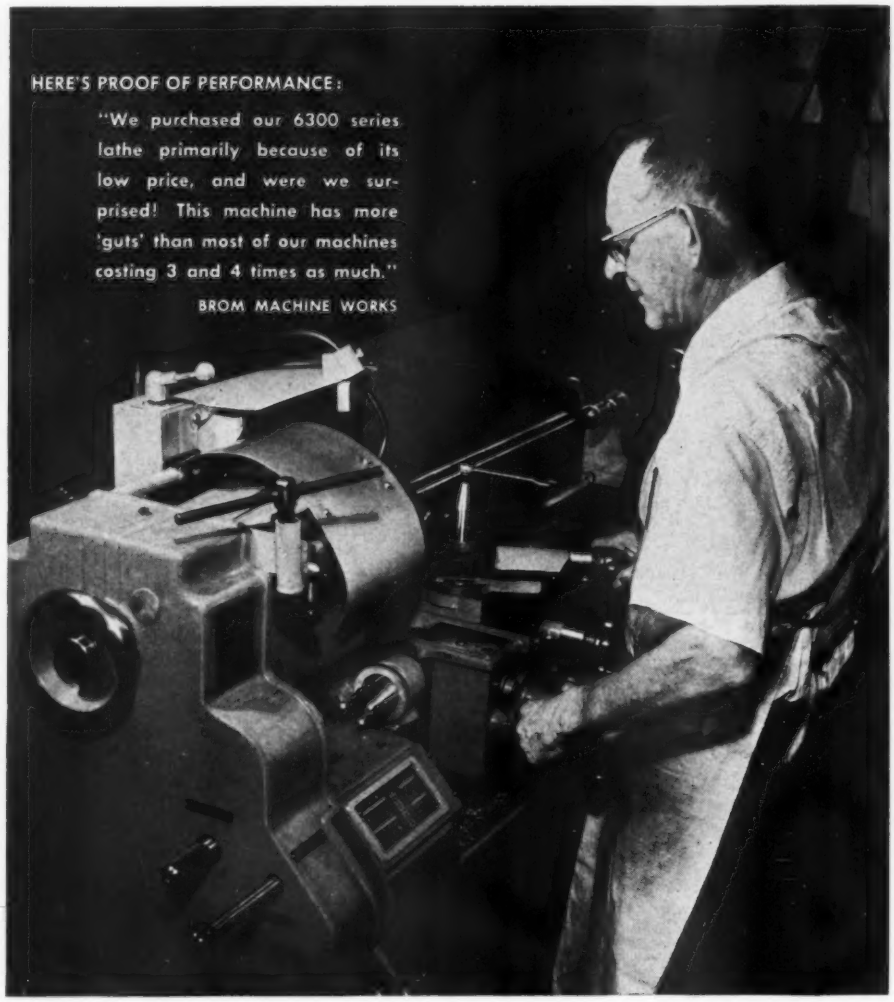


Note heavy-duty construction of the 10-speed countershaft . . . the six ball bearings for smoothness and long service. Also available with heavy-duty variable speed countershaft.

Flame hardened bed ways are standard equipment at no extra cost — a feature that costs many dollars more in other lathes in the Clausing class.


HERE'S PROOF OF PERFORMANCE:
"We purchased our 6300 series lathe primarily because of its low price, and were we surprised! This machine has more 'guts' than most of our machines costing 3 and 4 times as much."
BROM MACHINE WORKS

BOUGHT on price—PRAISED for performance

"CLAUSING 6300 LATHE out-performs expensive machines"

The reaction of Brom Machine Works to the performance of their Clausing lathes is typical. Clausing 6300-series 12¾" lathes *do* set the standards for accuracy, efficiency and value in their price and capacity range. Here are a few of the reasons why.

Flame hardened bed ways are standard equipment *at no extra cost* on Clausing lathes. Headstock, apron and quick-change box are totally enclosed and gears and shafts travel in bath of oil — another important exclusive. Spindle is forged steel with 1⅛" bore, hardened and ground ASA — L-00 tapered key-locked nose. Spindle turns on Timken zero precision tapered roller bearings. Tailstock has No. 3 MT ram.

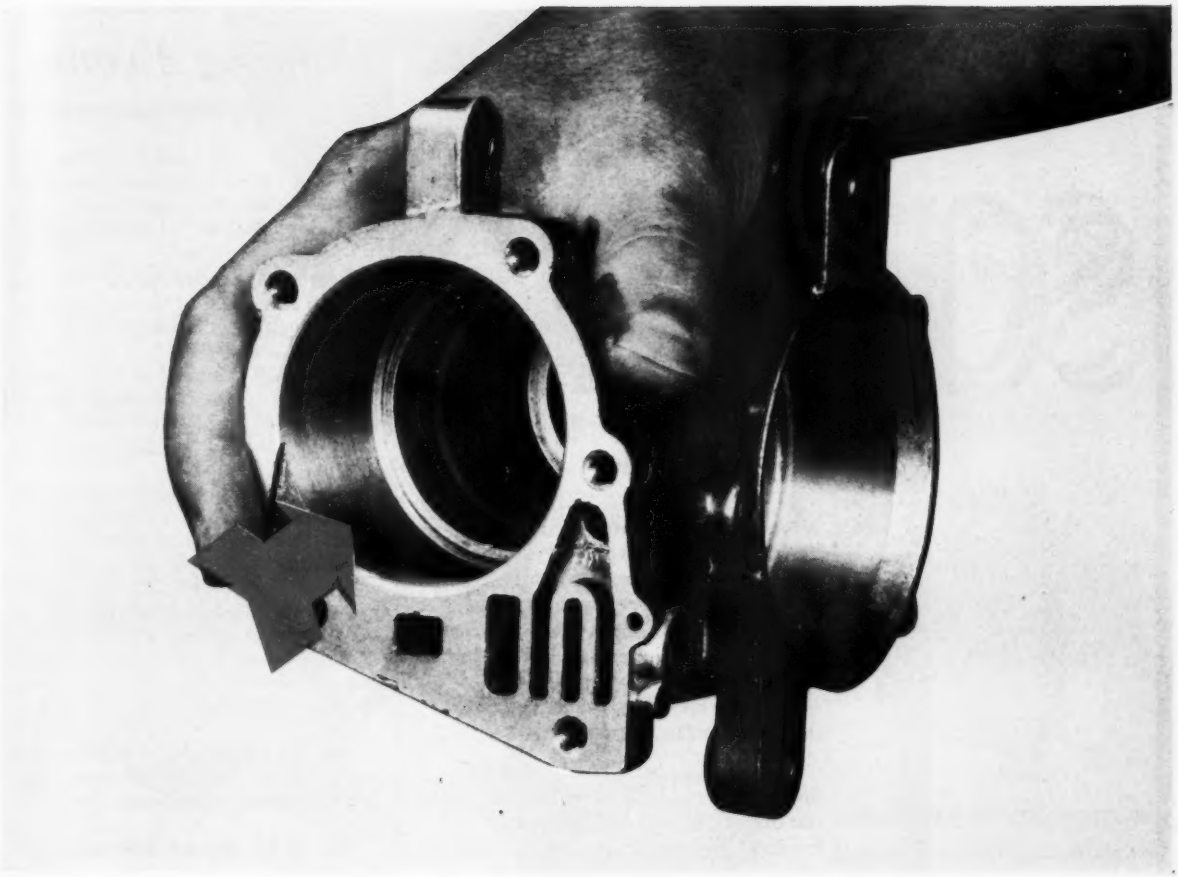
And superior performance is assured by more than superior features. Before it leaves the factory each Clausing lathe must pass rigid tolerance tests such as: spindle nose run out 0 to .0003" TIR, spindle taper run out at end of 12" test bar, 0 to .0006". The individual test report accompanying each lathe is an assurance it will machine with *dependable* precision. Compare *all* the features. Compare price. See for yourself why Clausing is acclaimed an outstanding lathe value — *the* lathe for *your* shop.

Write for free Literature

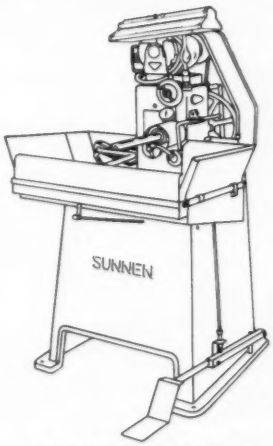
CLAUSING

CLAUSING DIVISION
ATLAS PRESS COMPANY
1-115 N. PITCHER ST. · KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 54



HOW WOULD YOU PRECISION-FINISH THIS BLIND HOLE?



Diameter range of standard honing tools: 1/8" to 2 5/8".

This die-cast aluminum valve part called for a geometrically perfect round hole . . . with maximum finish of 16 micro-inches, neither obtainable on precision boring equipment.

The simple solution was to follow the boring operation with Sunnen Honing . . . leaving just enough stock to correct errors and produce the required finish.

Sunnen Honing maintains previous alignment, guarantees tolerance to .0001" . . . and assures consistent precision-finish from part to part. The part stabilizes itself on the honing tool and requires no chucking or fixtures. Thus, the hole can be gaged at any time until the specified size is reached. Result is geometric accuracy of roundness and straightness. No scrap loss!

Average Sunnen Honing Machine installation with tooling is about $1,000.

send for five informative

honing booklets

CHECK READER SERVICE CARD

SUNNEN PRODUCTS COMPANY

HONING

7928-M Manchester Ave. • St. Louis 17, Mo.

Canadian Factory: Chatham, Ontario

7616

CIRCLE INFORM-A-GRAM KEY NO. 55

There's a real POINT in using...

SCHRILLO

SINGLE-LIPPED COUNTERSINKS

Never before has there been a tool like the SCHRILLO SINGLE-LIPPED COUNTERSINK. Its smooth chatterless operation in even the toughest alloy steels makes it indispensable for efficient countersinking and external deburring applications. The cutting edge and rigid radial relief control are correctly designed for fast, clean cutting.

Produced of specially selected High Speed Steel and heat treated in our own plant to assure uniform hardness, this exclusive SCHRILLO tool comes in 7 body diameters, each in your choice of standard 60, 78, 82, 90, 100, 110 or 120 degree angulations.

This is another in the great family of quality products made exclusively for the tooling and gaging industry by SCHRILLO.

TOOL NO.	SIZE	SHANK	PRICE
3108	1/4"	3/16"	$2.05
3112	3/8"	1/4"	$2.40
3116	1/2"	1/4"	$2.95
3120	5/8"	1/4"	$3.85
3124	3/4"	1/4"	$4.35
3128	7/8"	1/4"	$5.25
3132	1"	1/4"	$6.35

(When ordering, specify angulation.)

SCHRILLO
AERO TOOL ENGINEERING COMPANY
LOS ANGELES 46, CALIFORNIA, U.S.A.
WRITE TODAY FOR FOLDER NO. 101D AND NAME OF DEALER NEAREST YOU

CIRCLE INFORM-A-GRAM KEY NO. 56

Coming Events

Jan. 6-8. IRE, ASQC, AIEE, and RETMA. Fourth National Symposium on Reliability and Quality Control. Hotel Statler, Washington, D. C.

•

Jan. 13-17 and Feb. 24-28. Machine Design Seminars. The Lincoln Electric Company, Cleveland, Ohio.

•

Jan. 13-17. Society of Automotive Engineers. Annual Meeting. Sheraton-Cadillac and Statler Hotels, Detroit.

•

Jan. 14-15. Instrument Society of America. Second Yankee Instrument Fair and Symposium. Hotel Bradford, Boston.

•

Jan. 17. National Association of Architectural Metal Manufacturers. Metal Curtain Wall Division Meeting. Builders Club, 228 North LaSalle St., Chicago.

•

Jan. 17. Malleable Founders Society. Semi-Annual Meeting. Hotel Cleveland, Cleveland.

•

Jan. 22-24. Second Electronics Industry Association Automation Conference. Arizona State College, Tempe, Arizona.

•

Jan. 27-30. Plant Maintenance and Engineering Conference and Show. International Amphitheatre, Chicago.

•

Jan. 27-Feb. 6. University of California, University Extension. Two-week course on higher management responsibilities. Los Angeles Campus, University of California.

•

Jan. 28-31. Society of the Plastics Industry, Inc. 14th Annual Technical Conference. Sheraton-Cadillac Hotel, Detroit.

•

Jan. 30-31. American Society for Engineering Education. 10th Annual College-Industry Conference. University of Michigan, Ann Arbor, Michigan.

•

Feb. 4-6. Society of Plastics Industry. 13th Annual Technical & Management Conference. Edgewater Beach Hotel, Chicago.

•

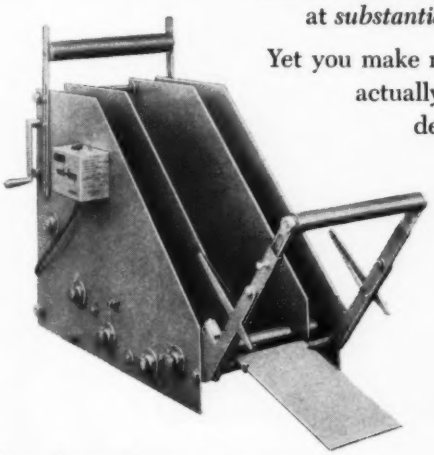
Feb. 6-7. Malleable Founders Society. Technical and Operating Conference. Wade Park Manor, Cleveland.

benchmasters
make 2-WAY savings!

Higher Operating Speeds — *Lower Original Costs*

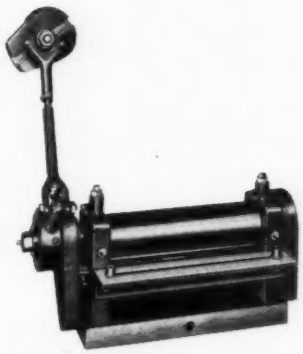
Benchmaster offers a complete range of machine tools—at *substantial cost savings* over larger equipment.

Yet you make no sacrifice in quality or performance... actually improve production! Write for details on these proven tools!



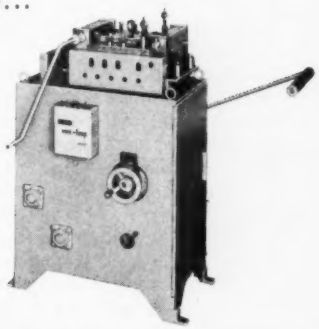
benchmaster KOIL-KRADLES

Supplies a slack loop from which any machine can freely draw; puts more footage through any machine, eliminates heavy lifting.



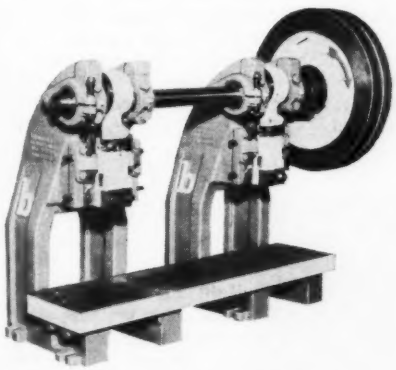
benchmaster AUTOMATIC FRICTION ROLL FEEDS

Totally new friction spring clutch now eliminates wear, maintains accuracy on every stroke! Fits most presses. 3"—6"—9" roll widths, 0-3" cutoff or 0-6" cutoff. Larger widths on special order.



benchmaster STRAIGHTENERS

Insures flat parts and better work from every coil. (Note: Koil-Kradles and Straighteners also available as combination units.) Optional: Electric Clutch & Brake.

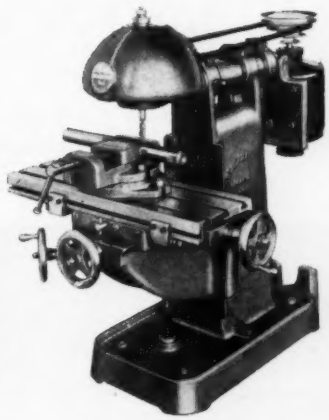


benchmaster MULTIPLE RAM PRESSES

Substitute for a low cost SHEAR or BRAKE with big savings.

benchmaster PUNCH PRESSES

Benchmaster's higher crankshaft speeds usually double production over large slow presses! 2, 5, 8 and 10-ton capacities, all press types.



benchmaster MILLING MACHINES

A real production mill that converts from horizontal to vertical milling simply by exchanging spindle quills!

Write for literature and quotations. Dealers everywhere!

benchmaster

World's largest manufacturer of small punch presses and mills.

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CIRCLE INFORM-A-GRAM KEY NO. 57

ON JOBS LIKE THIS CORBIN TURNS TO U.S. MULTI-SLIDES®

The Corbin ball bearing latch bolt retractor is just one of a multitude of stampings which can be produced — complete, without secondary operations, handlings or inspections — on U. S. Multi-Slide Machines. In the U. S. Multi-Slide, a combination of motions built into the machine itself greatly simplifies the designing of tools to fabricate precision formed metal stampings. Because these motions are part of the standard machine equipment, it is not necessary to incorporate complicated movements into the dies. Standard equipment on the machine includes: ram action for cutting, piercing, trimming, embossing, etc.; a four-slide forming position; and vertical movement for stripping and transferring. U. S. Multi-Slide Machines are built in four sizes, and on the three larger units it is possible to use two or more rams simultaneously. These features make the U. S. Multi-Slide extremely versatile in the automatic, high-speed production of all types of formed metal stampings.

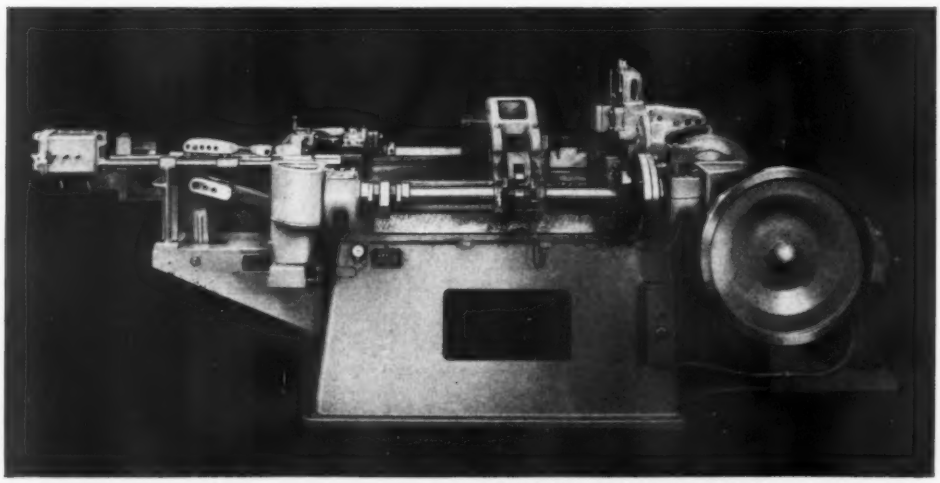
If you want to produce parts uniformly . . . at high speeds . . . and to close tolerances, write for a copy of Bulletin 15-P, or send part drawings or samples for our recommendations.

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

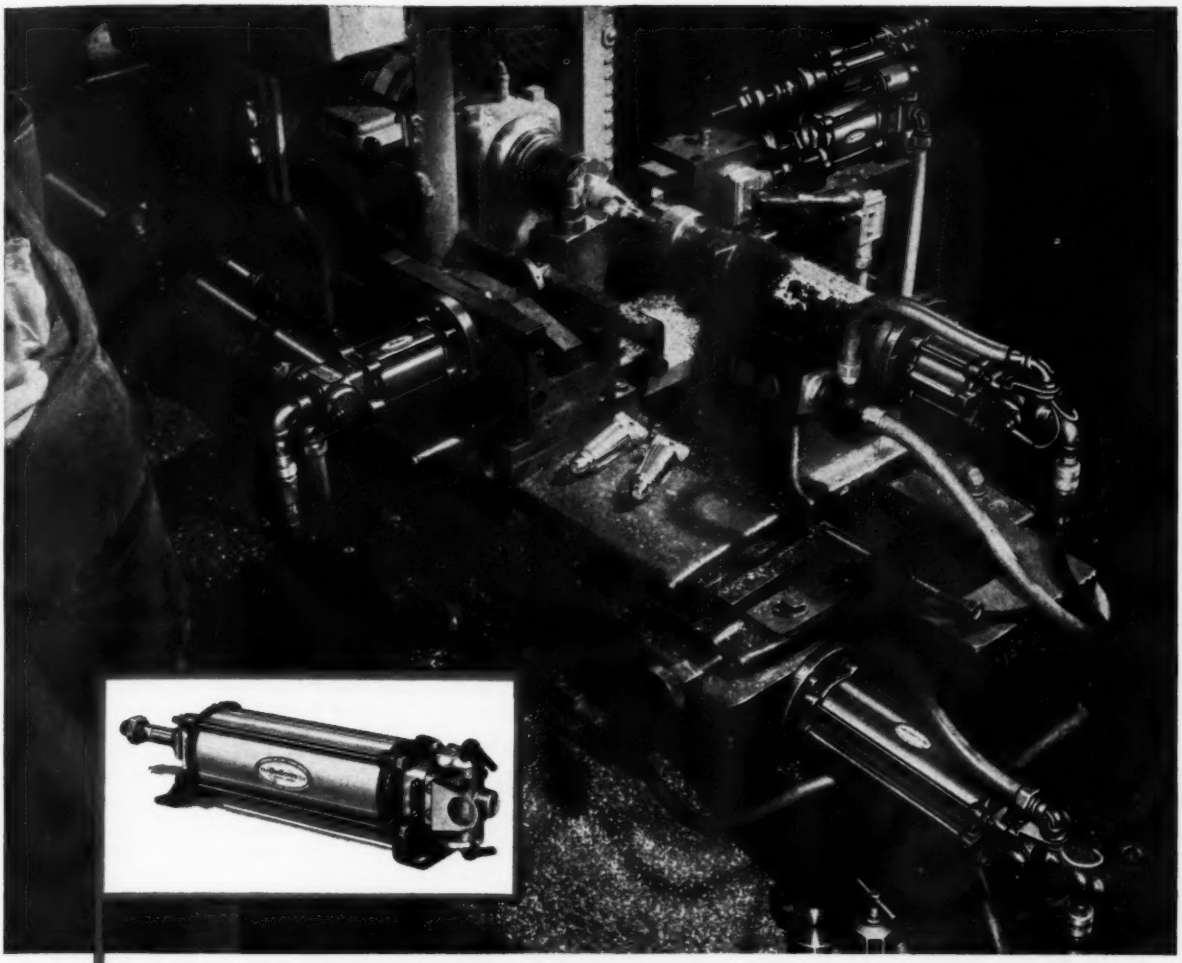
Builders of U. S. Multi-Slides — U. S. Multi-Millers
U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

The Corbin Latch Bolt Retractor shown above illustrates the unique ability of the U. S. Multi-Slide to produce thousands of uniformly precise parts — faster and better. Completely formed to close tolerances from strip metal, this part is non-jamming, self-aligning and practically indestructible. Thus, it imparts to Corbin Locksets the famous "velvet glide" knob action, long life and trouble free service — qualities which were found previously only in higher priced custom units, but which are now, thanks to U. S. Multi-Slides, an integral part of every Corbin Standard Duty Residential Lockset.



Left: The U. S. No. 35 Multi-Slide Machine used, with appropriate tooling, to produce the Corbin Latch Bolt Retractor shown above.

CIRCLE INFORM-A-GRAM KEY NO. 58



THE BELLOWS AIR MOTOR WITH ITS BUILT-IN ELECTRIC VALVE OFFERS NEW WAYS TO TRIM COSTS IN MANY VARIED OPERATIONS

In every industry you will find this unique air cylinder sparking cost reduction ideas and delivering that cost reduction in hundreds of different ways . . . from packing gardenias to drilling holes; from sorting conveyor traffic to lifting hospital beds; from feeding turrets to spinning rivets. The Bellows Air Motor puts "practical" automation within the reach of every plant.

Here's a typical example:

Hays Mfg. Co., Erie, Pa.: Chief Engineer Henry Schneider working with Frank Moore, Bellows Field Engineer, designed conversion (shown above) of a mechanically driven standard machine for turning tapered brass valve plugs, to a completely automatic air-powered operation. The application of the Bellows units was made in Hays' toolroom. Now, two men at two converted machines turn out more production than was previously obtained from four machines and four operators. Also, the quality of the finish on the plugs produced on the Bellows equipped machines eliminates 50% of the lapping time required by the old machining method.

What can it do for you? It can provide an inexpensive, easily controlled power source to perform almost any push, pull, lift or turn motion. It can make such standard machines as drill presses, lathes, millers, grinders fully automatic. It can be the heart of shop built, low cost, special purpose machines. *It can give you a fresh, new approach to the problem of cutting costs.*

Your Bellows Field Engineer (listed in the phone book under The Bellows Co.) will be glad to discuss possible applications with you. Or write The Bellows Co., Dept. TP-158, Akron 3, Ohio, for copies of Bulletins ML-3 and BM-25. In Canada, address Bellows Pneumatic Devices of Canada, Ltd., Toronto 18.

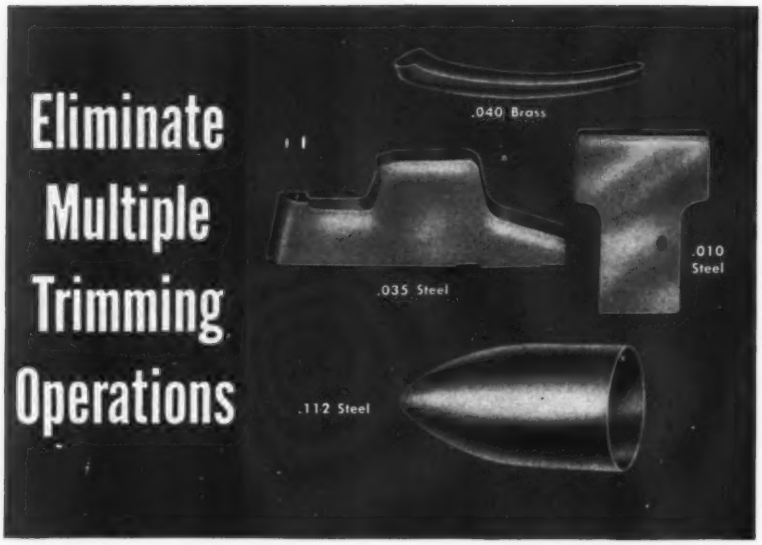
The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

9798

CIRCLE INFORM-A-GRAM KEY NO. 59



Increase output . . . reduce costs!

Costly, time-consuming trimming and notching operations can be done in one operation with a Brehm Trimming Die. Don't worry about stock thickness. Edges will be of full thickness — clean, flat, without burrs or distortion at the trimmed edge.

Other Brehm Die advantages! **Workable Materials** — gold, silver, stainless or mild steel, copper, brass, refrigerator doors, auto bumperbuf zinc, aluminum, fiber, rubber, plastics, **Quantities vary** — Stove or refrigerator doors, auto bumper buffers or typewriter covers, from 264 to 900 per hour. Intermediate parts, where stock and scrap can be blown from the die, about 1200 per hour. **Shapes** — fountain-pen ferrules, artillery cases, watch cases, burial vaults, automotive, kitchen, radio and television accessories and parts. Almost anything you need trimmed.

A Brehm "Shimmy" Trimming Die with angular cams, cuts four ways in one press stroke, handling straight or curved edge contours, with multiple notches and projections. Slow, costly "horn" and "pinch" trimming operations, are eliminated.

Submit part prints for our quotation on shells to be trimmed, or blanked, formed or pierced also.

THE SHIMMY DIE — VULCAN TOOL COMPANY — REGISTERED U.S. PATENT OFF.

Brehm® trimming dies

41ST YEAR OF VULCAN SERVICE

ENGINEERING • PROCESSING • BUILDING • TOOLS
DIES • SPECIAL MACHINES • VULCANAIRE JIG
GRINDERS • MOTORIZED ROTARY TABLES • BREHM
"SHIMMY" AND RELATED DIES • AUTOMATION

VULCAN TOOL CO. (YOUR TOOL ROOM IN DAYTON)
BREHM DIE DIVISION • 741 LORAIN AVENUE • DAYTON 10, OHIO

VULCAN tools

CIRCLE INFORM-A-GRAM KEY NO. 60

"Commendable Comments"

"The people concerned with producing close tolerance parts must know a machine's capability before they can make accurate decisions about its use . . . . We have found that accurate decisions regarding machine capabilities can be made when we use statistical quality control findings, fortify them with sound logic, and apply them with common sense."

—Edward Oakley, supervisor of Quality Control, Delco-Remy Division of General Motors, speaking at the 12th Mid-West Quality Control Conference.

"Sputnik may well be the catalyst which brings about drastic and long overdue reforms in utilizing the nation's intellectual capacities. It may thus do in matters of the intellect what Pearl Harbor did in matters industrial and military. Then as now a dramatic occurrence suddenly revealed that we had failed to develop our capacities to their maximum potential. But as we found then that in a national emergency we could take prompt and vigorous action and perform industrial miracles, so I am convinced we can now take similar action and perform educational miracles."

—RADM H. G. Rickover, USN, Chief, Naval Reactors Branch, Division of Reactor Development, U. S. Atomic Energy Commission, and Assistant Chief of the Bureau of Ships for Nuclear Propulsion, Navy Department, addressing Thomas Alva Edison Foundation, Inc. Engineering Society.

"Success in industry comes only through the development of a trained and well-coordinated team. The team includes everyone on the payroll but the inspiration, encouragement, and guidance must come from management. Management, including executives, supervisor, and foremen can only do a good job if they succeed in convincing those whom they supervise that they are also a part of the team."

—General H. F. Safford, president Ohio Rubber Company, in response to being honored as the National Management Association's Management Man of the Year.

"When a company has confidence in its ability to produce quality products economically, then it logically follows that this company will make or break on its ability to sell efficiently. Because distribution costs are such an important part of our make-and-sell operation, the opinions of marketing heads carry a great deal of weight in our product planning."

—Lloyd A. Dixon, Jr., vice president, Rockwell Manufacturing Company, Meter and Valve Division, speaking before National Industrial Conference Board.

Small-lot production of step shafts more than triples

...when Warner & Swasey No. 3 Electro-Cycle® with Versatile Step Turner, Handles the Job at Hobart Brothers Co., Troy, Ohio

Also, their Electro-Cycle's flexibility and ease of job changeover permit the handling of a wide variety of less complex work in lots of 5 to 50 pieces. As many as 17 jobs have been completed during a 9-hour shift!

Hobart Brothers Co., one of the world's largest manufacturers of electric arc welding equipment, relies on their new Electro-Cycle Turret Lathe to machine a majority of the smaller turned components in their motor generator sets.

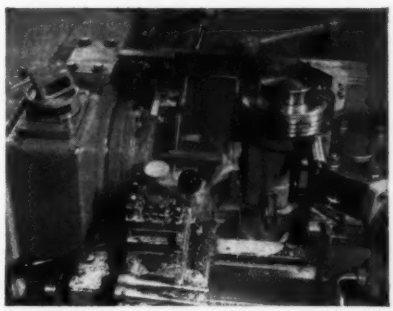
The Electro-Cycle's Step Turner attachment enables the automatic turning of five separate diameters in a single setup. The part being machined is completed by using only five stations on the hexagon turret—end stop, center bar end, center support, step turn and then thread. Necking for grinding and thread relief is easily handled from the square turret.

As all shafts are subsequently ground, Hobart holds their machining tolerances to +.005" −.000". These tolerances are easily handled by the versatile Step Turner attachment.

An AISI 4140 steel governor shaft was formerly produced at the rate of 2 to 3 pieces hourly—now one is finished each 4 to 5 minutes. As their shafts are produced from standard mill lengths of bar stock, the Electro-Cycle's Power Bar Feed and Collet Chuck have proved to be a great fatigue-saver to the operator.

Contact your nearest Warner & Swasey Field Representative to get the complete story on how Electro-Cycles can radically improve your production—and profit picture, too. He's as near as your telephone, so call today.

® Reg. U. S. Pat. Off.



On this versatile Step Turner attachment—once the initial cutter setting has been established—two to four different diameters can be easily selected by simply turning the micrometer dials to desired diameters. If needed, a fifth diameter may be obtained by using the stop screw located at the lower rack's end. Step Turners are available with diameter capacities ⅜" to 1½", shoulder lengths variable as required, with a total length limitation of 10 inches.

This Electro-Cycle Turret Lathe, shown operating at Hobart Brothers Co., is used for both long and short run production. Automatic, electrical control of all spindle functions greatly reduces machine handling time. They handle a wide variety of jobs in materials from copper and brass up to the toughest alloy steels used today.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

CIRCLE INFORM-A-GRAM KEY NO. 61

MEN YOU SHOULD KNOW

Daniel C. McCarthy, Jr., has been named to the newly-created position of director of manufacturing planning for Chrysler Corp. He was formerly an assistant to the director of the corporate manufacturing staff. **V. P. Masi,** formerly manufacturing manager of the Mound Road Engine Plant, has been named plant manager of the Joseph Campau Engine Plant of the Engine Division. Former general superintendent of the pressed steel division of the Dodge Main Plant, **W. R. Gerber** has been appointed plant manager of the Conant Stamping Plant of the Stamping Division.

◆

S. L. Johnson has taken over as manager of the New Methods Development Section, Coated Abrasives and Related Products Division, Minnesota Mining and Manufacturing Co.

◆

The new manager of industrial engineering at Raytheon Mfg. Co. is **Russell S. Rockafellow.** He will be responsible for the company's overall industrial engineering and related activities.

Harold J. Bergum has joined Nylok-Detroit Corp. as plant manager in charge of the company's new manufacturing facilities in Troy, Mich. His responsibilities will include direct supervision of all processing operations for Nylok-Detroit's line of patented self-locking-sealing-adjusting threaded parts.

◆

David G. Collins has been named vice president of SpeedWay Mfg. Co., a subsidiary of Thor Power Tool Co. Collins will be in charge of the firm's Electric Motor Division.

◆

Leonard M. Clark and **George F. Hagger** have been appointed vice president and vice president of engineering at Snap-Tite, Inc., respectively. Clark was formerly sales manager and Hagger was director of engineering. Clark will also serve as treasurer.

◆

V. L. Bradford, executive vice president of the Milford Rivet & Machine Co. becomes president of the organization, to succeed **F. H. Merwin** who will become chairman of the board of directors.

Arthur W. Ackerman, Jr., has been named assistant to the executive vice president for Huck Mfg. Co.

◆

George C. Johnson has been named president and general manager of Rehnberg-Jacobson Mfg. Co., after serving the company as chief engineer and factory manager.

◆

Changes in Valvair Corp., Sinclair-Collins Valve Co., executive positions have been announced. **J. E. Collins,** former president, has been elected to the newly-formed post of chairman of the board. Former executive vice president, **W. F. Kruspe,** succeeds Collins as company president and general manager.

◆

Tomkins-Johnson Co. has announced that **John E. Rowe** is now serving in the newly created post of executive vice president. **William J. Remund** has been promoted to sales manager, and **Adam P. Jankowski** has taken over as sales manager.

◆

Emmett C. Miller is now working as methods engineer at the Maytag Co.

The COST of a drill bushing depends on

MEN YOU SHOULD KNOW

G. T. Willey, The Martin Company's corporate vice president of manufacturing, has assumed additional duties as vice president and general manager of a new division which will arrange two missile launchings.

◆

New design engineer in the Instruments Division, Philips Electronics, Inc. is **Norman Malkin.** He will work with problems associated with electron microscopes and x-ray units for element and atomic structure analysis.

◆

The appointment of **Wladimir A. Reichel** as senior vice president of Norden-Ketay Corp. has been made known.

◆

Robert A. Lehman has been appointed executive vice president, general manager, and a member of the board of American Electronics, Inc. **E. F. Echolds** is chief engineer of the firm's Electro-Mechanical Division. He will be responsible for the division's engineering effort and the continuing improvement and expansion of its product line.

Newly elected president of Joy Mfg. Co., is **William L. Wearly. A. B. Drastrup** was recently elected executive vice president.

◆

Charles McCullough and **Richard P. Quintin** have been named to new positions at Allis-Chalmers' Norwood (Ohio) Works, the former to a post in the manufacturing department and the latter as an assistant in methods engineering. New assistant general manager of the Terre Haute Works is **Howard C. Carless.** He was formerly engineer-in-charge of transformers at this location.

◆

Hyster Co. has appointed **Paul Fischer,** formerly chief methods engineer, to the position of manager of the Portland Manufacturing Plant. He will be responsible for the functions of the plant pertaining to manufacturing, personnel, traffic, purchasing, and plant engineering.

◆

The appointment of **Don W. Branning** as manager of the American Broach and Machine Division, Sundstrand Machine Tool Co., has been announced by the company.

The National Acme Co. has made known the election of **T. Laurence Strimple** as chairman of the board and president.

◆

Square D Co. has named **Daniel H. Miller** manager of the Western Division, with headquarters at Los Angeles. Serving in the newly created post of works manager of the expanded operations of the Industrial Controller Division is **Paul A. Christenson.**

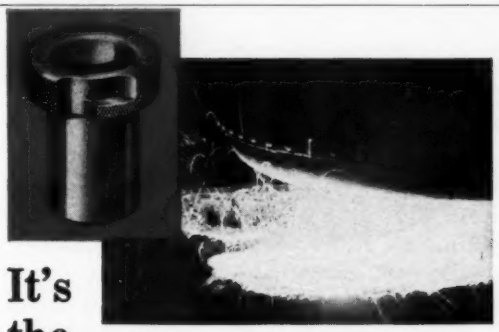
◆

The board of directors of Progressive Welder Sales Co. has announced the election of **Ray W. Heiden** as president and general manager of all the company's plants and operations. **Harry S. Rose** was appointed vice president, national sales manager, and member of the board of directors.

◆

Joseph S. Jonkey has joined Consolidated Electrodynamics Corp. as production manager of the Glendale Division. Chief engineer for the company is **Herbert I. Chambers,** formerly assistant chief development engineer.

its working LIFE!



It's the *steel* in ACE drill bushings... *that makes the difference!*

When working life is doubled . . . bushing costs are cut in half! Fewer bushing changeovers add *bonus production savings!* That's why ACE drill bushings of new high-carbon chromium steel are being *specified exclusively* by cost-conscious tool men everywhere! Make a *working comparison* NOW with any other make bushing . . . and see "Positive Proof" that *the steel makes the difference!*

Write for the all new 1957 ACE Catalog and the name of your nearest distributor. DEPT. F-3

ACE DRILL BUSHINGS

ACE DRILL BUSHING CO., INC.
5407 FOUNTAIN AVE., LOS ANGELES, CALIF.
ACE DRILL BUSHING CO. EASTERN INC.
611 McCARTER HWY., NEWARK 5, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 63

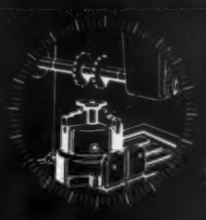
NEW

ERICKSON

MASTER SPACER

with No. 0 Timken Bearings

gives increased production and optimum accuracy in



straddle milling

milling

jig drilling
with either micrometer or "Jo" block setting

inspection

Write for free catalog "Erickson Master Spacer" today. And at the same time request your copy of Catalog K; you'll find cost-slashing applications for all Erickson holding tools.

The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

AA-3991

ERICKSON TOOL COMPANY

34351-1 Solon Road • Solon, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

CIRCLE INFORM-A-GRAM KEY NO. 64

To A Russian Teen-Ager

Dear Ivan:

We have been greatly interested in current reports covering your school activities and progress.

You who have elected — or have been "persuaded" — to follow a career in the physical sciences because of your aptitudes, are seemingly dedicated to the proposition that Communism's efforts to encircle the globe can be realized.

That this is not true you won't believe. You have been, and are being, taught that this is so by your political leaders. We really can not blame you for not considering things that you don't know.

What has undoubtedly been kept from you is the true history (and remember that history has a faculty for repeating itself) of what democracies have done (and, therefore, can do) when really aroused by such warlike gestures, threats, and machinations as are currently being engaged in by your head man.

He is drunk, a great deal of the time on vodka, and all of the time on power. We are perfectly willing to leave it to history, and not too distant history, to deal him a hangover that the world will never forget — and will be a better world for it.

This, however, is a bit aside from the part you are playing. Could it possibly occur to you, as you are being led by the nose into the "glorious" career of scheming to kill off or enslave all those who refuse to be deluded by Communism's proved-hollow promises, that you have become the unwitting tool of the philosophy that is the diametrical opposite of Communism, i.e., Free Enterprise?

If the situation weren't serious, it would be funny. You, in pursuing, under orders, your scientific education have fallen for the one thing to which our country is dedicated — and for which our country is the envy of the entire world! And that is Free Enterprise and its high standard of living!

You Russian science and engineering students are now the fair haired boys of your generation, and for your efforts you are beneficiaries of better living quarters, better food, better clothing, the better everything that goes hand in hand with our system of Free Enterprise.

If your leaders didn't know how susceptible ambitious man is to these creature comforts, do you think for one minute that you could have or earn a better standard of living than your druggist, elevator operator, lawyer, or locomotive engineer?

You know full well that if your masters thought that YOU embryo scientists could attain THEIR ends by attending classes in a salt mine, you'd be attending classes in a salt mine!

How long can this go on? How long will your contemporaries in more mundane pursuits and occupations tolerate such a materialistically favored class as you scientists. It's against all the teachings of a classless Communism.

What will happen when your political leaders are no longer around to make military use of the skills of your class?

What will happen when your neighbors awake to the fact that it is you who have brought that inevitable devastation to what little they have and cherish? Your masters won't let you believe this, but we will never start a war — only a retaliation! Do you think that if we were warminded we'd be caught trailing in satellites and missiles?

There has been much thinking in the democracies that the final way the world could be freed of the cancer of Communism would be by internal revolution — the Russian people against their despotic political and military strangleholders. Recently we have seen the ruthless ascendency of the political over the military — leaving only the politicals in the drivers' seats.

Doesn't it occur to you that you and your fellow scientists might become the hated class — just because of the retaliation you are willing to risk? And doesn't it seem at all likely to you that an internal revolution of one class against another — non-scientists against scientists — could well be the end of your beloved Communism?

In such an event do you think your then political rulers would be any more than cheerleaders on the sidelines? Meaning that if people are to be liquidated, why not let them liquidate themselves? It's much simpler.

You, Ivan, are in an unenviable spot. You are under compulsion to produce weapons for world and space war. At the same time your political leaders are under compulsion to not use them OR ELSE — we to provide the OR ELSE! Think it over, Ivan.

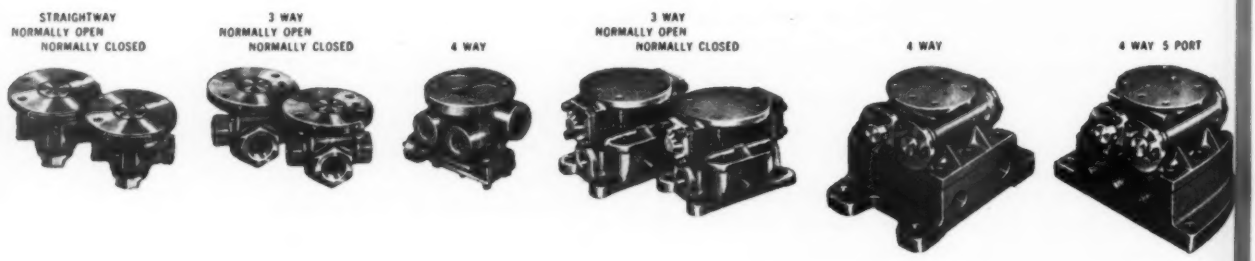
E. Willard Pennington

editor

Ross Skyline

Now-All the basic valves-*and more*-in this *long life* air valve series

match any head to any valve body!

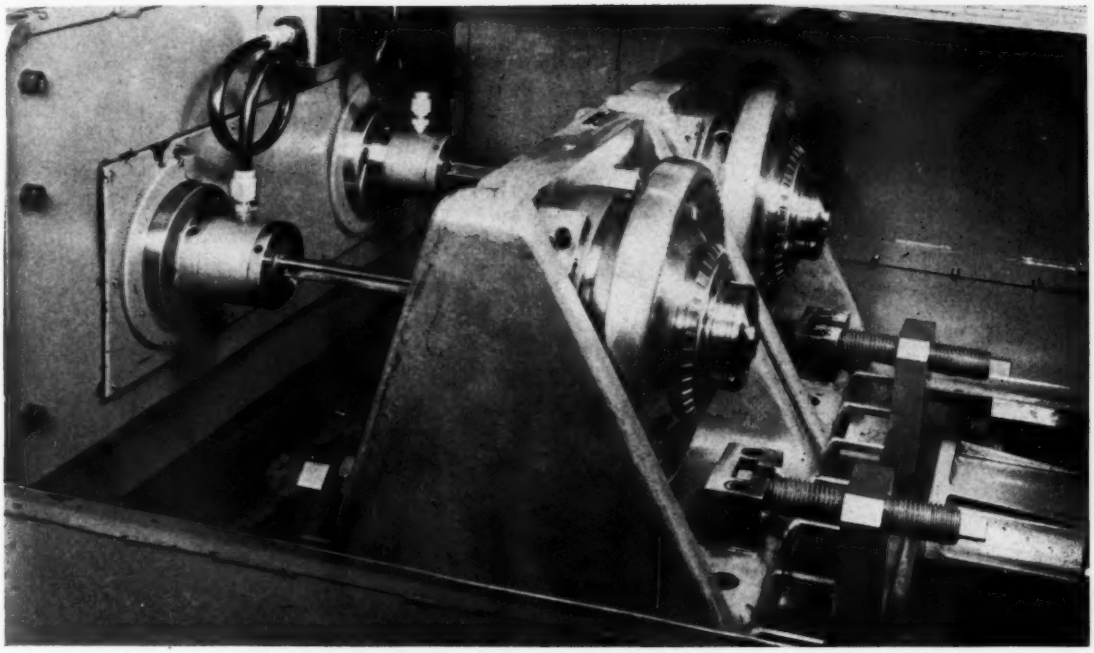


Now there are 11 heads and nine bodies to meet both usual and unique problems in the line which was designed to give you the longest life and greatest adaptability of any valve line in the world. All heads are readily interchangeable with all Skyline valve bodies, and the new Double-Stroke momentary adapter further multiplies the number of valve combinations. What is your problem? Drop us a note explaining it, or call your nearby Ross field service engineer for details on the Skyline valve to solve it.

Combining Engineering With Ingenuity for Better Air Control

Ross OPERATING VALVE COMPANY

123 EAST GOLDEN GATE AVENUE • DETROIT 3, MICHIGAN



This Bryant 2-spindle production setup with fluid transfers permits a double gundrill arrangement for precision boring at high speed.

THE BASIC SETUP FOR GUNDRILLING . . .

. . . PLUS Complete Do-It-Yourself Instructions for Making Gundrill Sharpening Gages

by Frederick S. Bloch
President
ELDORADO TOOL & MFG. CORP.
Milford, Conn.

INCREASING NUMBERS of manufacturers and contract shops are including specialized gundrill setups in their plants. They have found that in many operations, gundrilling offers work of exceptional accuracy, economy and quality. Well engineered facilities for gundrilling operations are responsible for producing holes of extreme concentricity, squareness, microfinish and critical tolerances at lower costs than hitherto possible by other methods.

The gundrilling process has progressed to such a degree that some shops are drilling up to 8 ipm in steel and up to 18 ipm in magnesium. Length of hole is of no consequence as depths from four to 230 diameters are drilled even in the newer high temperature alloys.

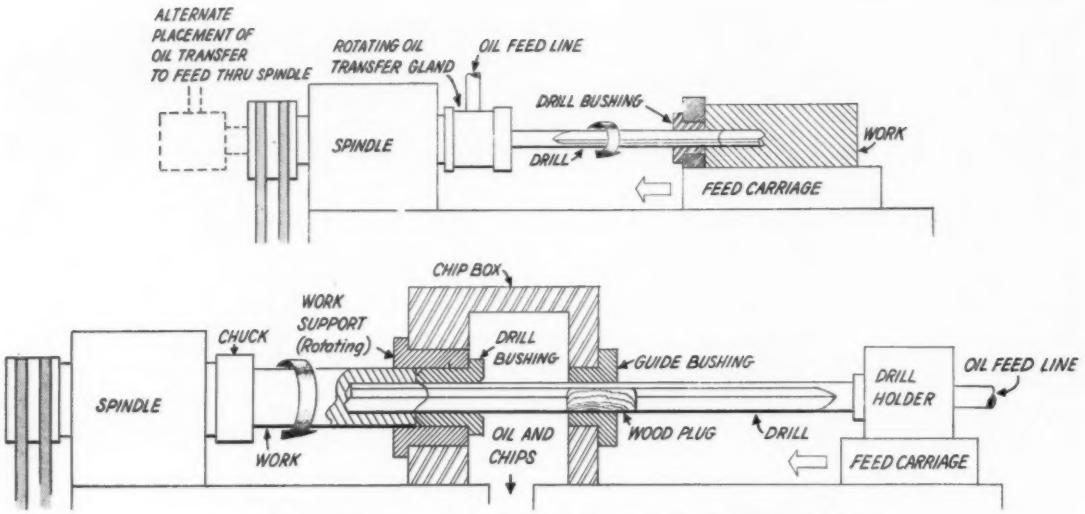


Fig. 1. The two alternative approaches to the gundrilling process, the choice depending upon the cumbersomeness of the workpiece. The upper view shows the work positioned on the feed carriage with the drill powered by the spindle. The lower view is of a rotating workpiece with the stationary drill fed by the carriage.

The critical factor in gundrilling is not the hole diameter, but rather the feed per revolution. This, of course, is usually predetermined by the material to be drilled. Figure 1 shows the two alternative approaches to gundrilling.

Drills ranging in diameter from 0.125" to 3.250" dia are common. Fitted with cutting edges of carbide and, in the case of large sizes, with two carbide guide surfaces (wear pads) on the drill, tool life is greater than that of conventional drills.

Any machine used for gundrilling must be extremely rigid and must operate with a minimum of vibration. The spindle must be capable of suitable drilling speeds and must have enough power to drive the drill without slowing down due to slippage or motor overload. The feed mechanism must provide feeds which are not uneven or spongy. Irregularity in feeding the drill can easily result in tool breakage. It is desirable to have a feed system which permits adjustment since feed must be changed according to the job.

A gundrill is precise because the drill is continuously piloted. The cutting edge is followed by the wear pads which guide the cut, "steer-

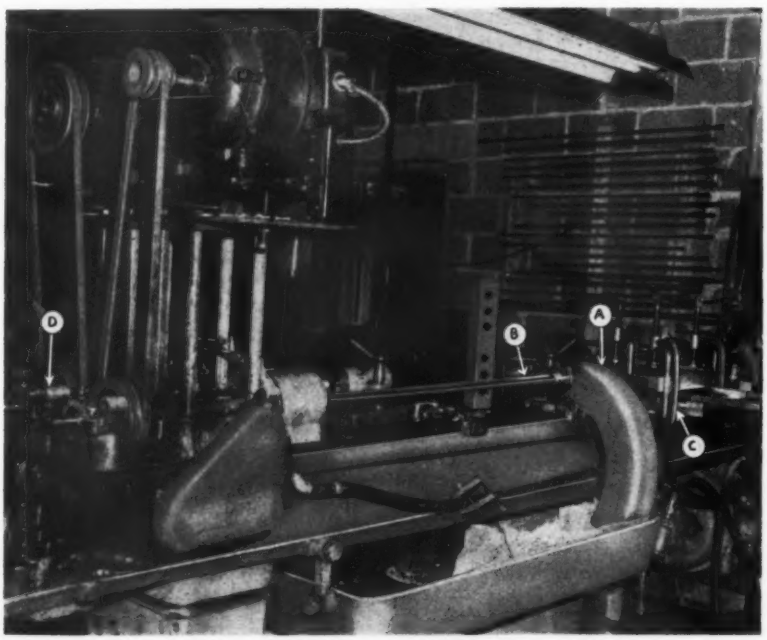


Fig. 2. A simplified gundrill setup. Bushing A is snuck up against workpiece at far right. Oil from within the bore through the drill flows out of flute B into pan. Effective despite its simplicity is fixture C holding workpiece. Machine can be set up D to handle drilling operations of two sizes at the same time.

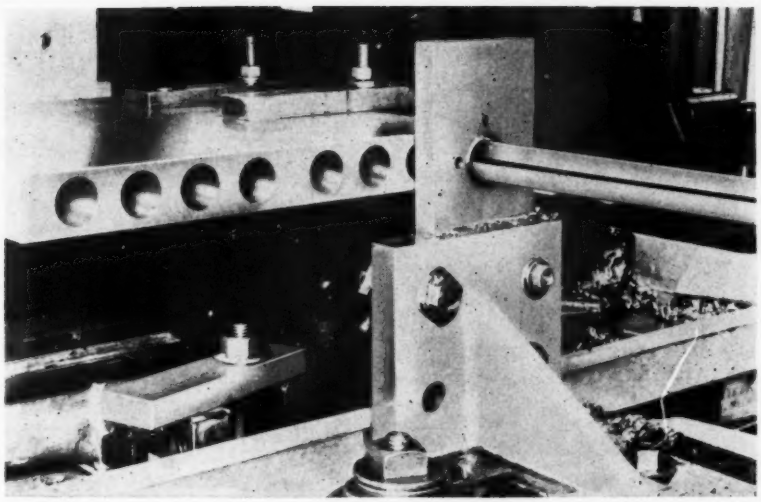


Fig. 3. A simple, rigid setup for drilling parallel holes in platens.

ing" from the already finished portion of the bore. Started straight, the drill continues straight.

To give it the required accurate start, a precision bushing that fits against the end of the workpiece is required. This bushing should be no more than 0.0002" larger than the basic drill size and should be discarded when it wears beyond 0.0005" oversize.

Lengths of approximately one to two diameters are standard for the accurate and critical portion of the bushing. The rest of the bushing may be relieved 0.001" to 0.003" on the ID. The bushing must be placed firmly against the work surface with no internal chamfer on the mating end. This also minimizes the possibility of chips catching at the bushing. For materials such as cast iron which form very small broken (and dust-like) chips, a small space can be permitted between the bushing and the work, but if this space is too large, the drill will not get adequate support at the start of the hole. In some cases, such as gundrilling in a lathe with the work rotating and supported in a chuck or steady rest, the drill can be started in an accurately pre-bored hole in the work or by attaching an accurately fitted bushing cap to the work. Figure 2 shows a double setup for handling two jobs at the same time.

Work-holding fixtures must be rigid and designed to hold the work to the required degree of accuracy of hole location. The fixtures should not clamp the work in such a manner as to cause it to spring as the drill removes metal. No clamp or support should be located on a surface which will be separated from the drilled hole by only a thin wall or this will cause collapse of the hole with a resultant broken drill or a spoiled hole. It is also recommended to put a cap at the hole's breakout point. This will keep the oil flowing back along the flute after the drill breaks through.

It is absolutely essential that the alignment of the machine and the drilling setup be carefully checked, adjusted and maintained. Machine and fixture misalignments cause job difficulties. Never take alignment for granted. It is best to align the drilling machine by using the spindle axis as reference. It is a job for good dial indicators and checking bars; truing should be carried out to at least 0.001"/ft of length for parallelism and concentricity at operating temperatures. Figure 3 shows a rigid setup of well controlled accuracy.

Other features of the drilling setup should include steady rests for long, non-rotating drills and whip guides for rotating drills, as well as hoods and splash guards to keep oil and chips confined within the machine.

One of the most important problems confronting the users of gundrills, or "deep hole" drills, as they are sometimes called, arises with the need for sharpening.

In some plants, costly or elaborate instruments such as comparators, microscopes, etc. are employed to check sharpening accuracy. In other plants, partly worn drills are discarded because toolroom personnel do not want to go through a fussy and lengthy procedure for accurately checking the drill geometry.

To overcome this problem, we have developed a simple sight gage which permits a quick and accurate check of the sharpening operation. The gage is inexpensive and easy for you to make.

Actually, gundrills are about the easiest tools in the shop to sharpen and check, once the proper technique is mastered. There are but two cutting edges, the inner and the outer nose

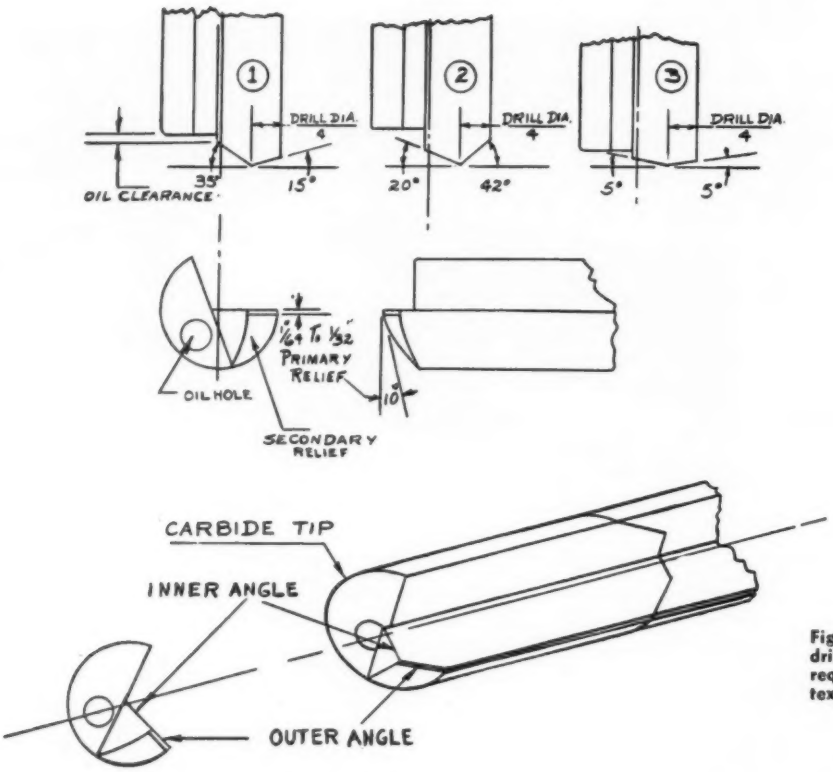


Fig. 4. These three styles of drill nose grind should meet the requirements of all jobs. See text for recommendations.

angles, that require sharpening and these can be sharpened several times before a complete nose regrind is necessary. Oftentimes the regrinding of the outer angle by a few thousandths is the only requirement.

Nose grind styles, Figure 4, are determined by the form of chip most easily removed by the coolant. The suggested angles should be tried as follows: nose styles 1 & 2, for free cutting materials of RC 22 and harder; nose

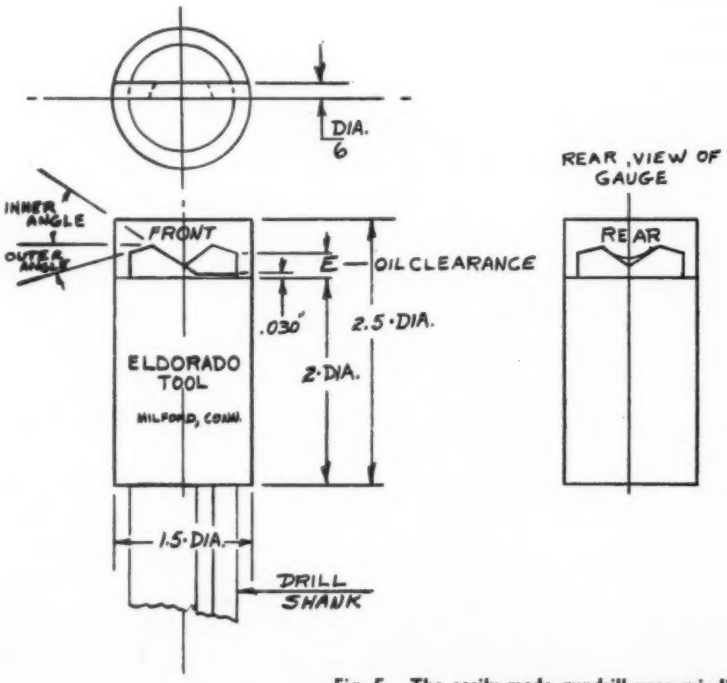


Fig. 5. The easily made gundrill nose grinding gage. One gage is made for each drill size.

TABLE "A"
OIL CLEARANCE DIMENSION

DIA.	E
.125	.06
.250	.07
.375	.09
.500	.12
.625	.16
.750	.19
.875	.21
1.000	.25

style 3 for all others. Some variations may be more convenient or, in certain cases, called for.

When you have determined which angles are best for your setup and materials, you are ready to make the "sight" gage shown in Figure 5. A gage for every drill diameter is required. The procedure is as follows:

1. Take any piece of screw stock. It must be at least four drill diameters long.

2. Gundrill the stock 3½ diameters deep or twist drill and bore to gundrill size, three diameters deep on a lathe. Next, put the gundrill in the tailstock, Figure 6, carefully feeding the drill (with your desired grind on it) in just enough to fully form the profile of the gundrill at the bottom of the hole. Be sure to use a light feed and ample cutting fluid.

3. Mill the blind end to centerline of the hole (axis) in front. Then mill away enough stock on the back side to leave 1/16" to 1/8" thickness of the sight-blade, Figure 7. The depth of location of this step will be the maximum tolerance for the oil clearance shoulder (see Figure 5, dimension E). To position the gundrill in the gage correctly, hold the flat surface of the drill flush with the front of the gage, Figure 8. Looking from the front you have a sight gage for both angles, and from the rear a gage for checking clearance and the inner angle.

4. Remove burrs and inscribe markings on gage for front, rear, and minimum tolerance for oil clearance shoulder, as indicated in Figure 5.

Now that you have made the sight gage there are only four steps to resharpening your gundrill:

1. Correct oil clearance step to dimension "E" (table A, Figure 5) with minimum of 0.030" tolerance.

2. Grind inner angle; using rear view of gage. Check angle through opening (see rear view, Figure 5).

3. Grind outer angle; using front view of gage. Check for angle accuracy and location by holding the drill flush with front surface of gage, Figure 5.

4. Chamfer 1/64" x 45° from top of shoulder to bottom of secondary clearance of outer angle.

All of these clearances can be viewed through the rear of sight gage. Unless the gundrills are very large, no secondary clearance is needed for the inner angle. The primary clearance land should be very small, not more than 1/64" on small drills. It is there simply to show that the correct clearance has been ground on the drill.

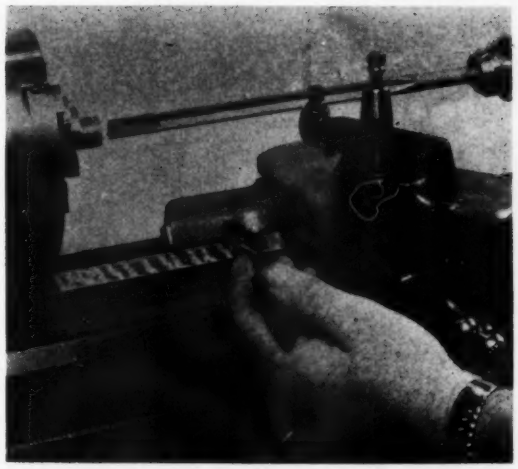


Fig. 6. Bottoming the hole of the sight gage. Carefully feed drill with desired grind just enough to bottom the hole, thus forming profile of gundrill nose. Be sure to use light feed and ample cutting fluid.

The parts mentioned herein are the ONLY parts of a gundrill that can be touched up. Touch up any other edge or surface and you have ruined the tool. The only effect, for example, of different relationships of nose angles to each other will be to form a different shape of chip. The determining factor for resharpening is the width of the wear land. Amounts to be ground off depend on the damage to be removed at the outer corner of the outer angle. Gundrills can be sharpened until there is practically no carbide left, or, in the case of inserted carbide tips, until the radius in back of

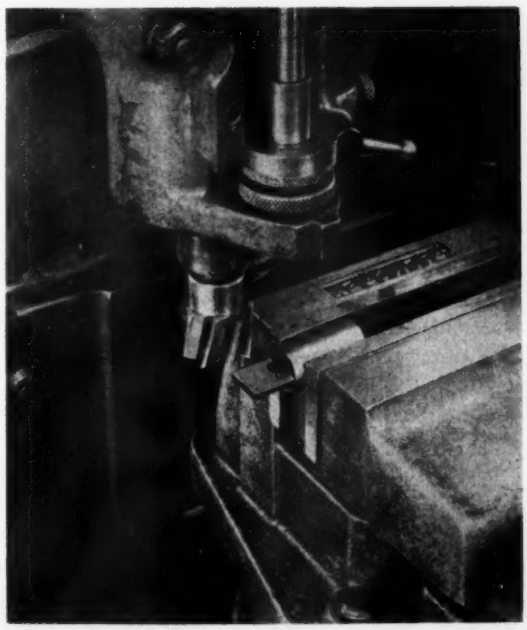


Fig. 7. Completion of milling rear side of Eldorado gundrill sight gage.

Fig. 8. Checking gundrill tip with sight gage. If light shows between drill tip and gage profile, sharpening is required.

the cutter meets the centerline of the tool. At 0.005"/sharpening, a 1" (usable) length of tool amounts to approximately 200 sharpenings. So it pays to be careful since the greater the number of unnecessary sharpenings, the shorter the tool life, and the greater the expense of diamond wheels.

For maximum efficiency, use diamond wheels of 180 to 320 grit. DIT (peripheral) wheels are easier to keep sharp and to dress than face wheels. In proper use and with good equipment, gundrills are the easiest tools in the shop to resharpen. Only two cutting edges and their clearances. What could be easier?

end

NUMERICAL CONTROL'S FUTURE BRIGHT FOR CONTOURING

IT WAS TRACER CONTROL VS. NUMERICAL CONTROL for contouring operations, at True-Trace Corporation's recent third annual Contour Machining Conference, but neither was declared unqualified winner. When the choice between the two is to be made, it is well to consider these points, said Douglas Aircraft's Carl B. Perry:

Numerical control delivers part geometry data to the machine without the need for physical analogs. Thus, a higher level of "machine management intelligency" may be delivered. Numerical control is good for highly complex parts which would require costly templates or cams, and for producing parts which are too complex for human-judged repetitive production. Generation of unpredictable machine or workpiece responses, however, is a serious problem for it.

Smaller shops especially will stick to tracers for a good many years, he believes, partly because of the skills and facilities available for efficient programming, and partly because of the data processing necessary for numerical control. Size of shop, type of work performed, and amount and complexity of profiling operations required must be weighed, Perry said, before making any changes. "As systems and machines are improved," he concluded, "more tracer equipment will be replaced by numerical control."

When industry creates a means for passing directly from the plans for a part in the mind of the designer to the detailed numerical instructions which will cause the desired part to be produced, numerical control's good will be realized, Douglas T. Rose, head of the computer applications group of Massachusetts Institute of Technology, told conferees. In discussing the M.I.T. "APT (Automatically Programmed Tool) system," Ross said that the research program must recognize that the disparate characteristics of the human programmer, the general purpose computer, and the numerically controlled machine tool "must be linked together in an overall system concept." "The lowest level (APT I) of the hierarchy has a minimum of automaticity and utilizes the general purpose as a calculating aid through the use of a library of subroutines. In the next level, the APT II system allows the part programmer to specify and produce a part by statements in the APT language which are made in terms of space curves rather than individual points as in the APT I system. The highest level of APT system which has so far been determined concretely is the APT III system, in which the statements in the language are made in terms of regions of the part, i.e., entire portions of machined surfaces."

"Although the development of automatic programming systems is expensive," Ross said, "the p o t e n t i a l i t i e s have hardly been scratched." It is a well known fact, he added, that research and design which go into production parts are extremely expensive items, so that any automatic system which can take over even a portion of these functions has a good chance of paying its own way.

Production Practices in the

FABRICATION OF STAINLESS STEEL HONEYCOMB SANDWICH STRUCTURES

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ESSENTIALLY, there are three basic types of sandwich structures (Fig. 1). They are honeycomb core, corrugated core, and waffle core. Variations of these include small individual tubes or cones and individual stringers attached to the facings of stabilization. All of these configurations reportedly have certain advantages. Honeycomb sandwich is isotropic, has high strength-to-weight ratios, and has many potential applications. Corrugated sandwich is anisotropic and does not have as wide a range of application as honeycomb. However, many people believe that corrugated and waffle sandwich are more feasible than honeycomb for high production rates and the fabrication of large panels.

At the present time, stainless steel honeycomb sandwich structures are being fabricated by brazing for use in aircraft and jet engine components. Most of these structures are being produced from Type 17-7PH stainless steel for use in the B-58 bomber. Thus far, these structures have proved to be satisfactory for their intended application. However, the cost of producing panels is high, and improved fabrication procedures are considered necessary be-

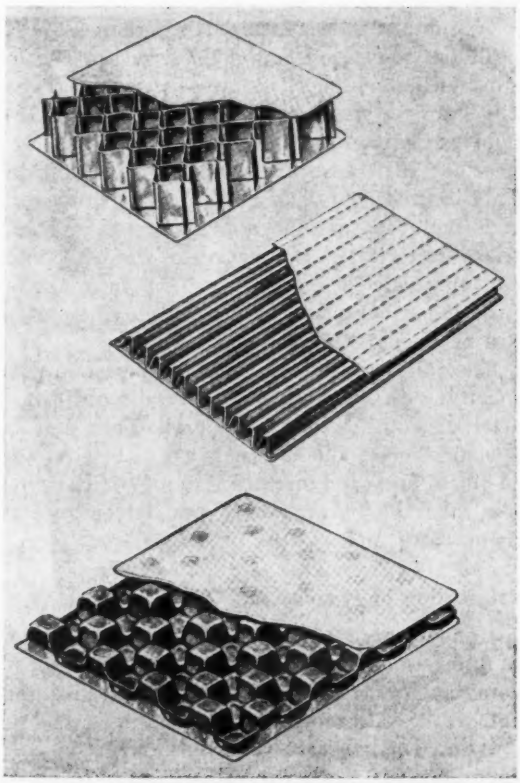


Fig. 1. Basic core configurations used in sandwich panels. Top — honeycomb; center — corrugated; bottom — waffle.

*This article has been adapted from the Laboratory's Report No. 79, to the Office of Assistant Secretary of Defense for Research and Engineering. The full report is entitled "Stainless Steel and Titanium Sandwich Structures."

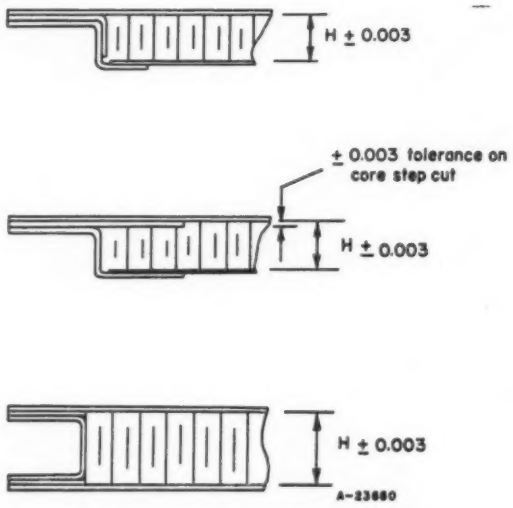


Fig. 2. Typical edge-member configurations.

fore such panels can be utilized to the fullest extent.

A considerable amount of development work is being done to improve methods for fabricating stainless steel sandwich structures. Under investigation are brazing, welding, and bonding for honeycomb sandwich structures, and welding for corrugated and waffle sandwich structures.

A number of materials other than 17-7PH stainless steel are being considered for use in sandwich structures. Some of these are Type 321 stainless steel, AM-350, A-286, Inconel, Incoloy, Haynes Stellite 25, and titanium. Except for 321, these materials are available in only limited quantities in foil form. However, it is believed that the availability of most of these materials is a function of demand, and that methods for converting them to foil on a production basis will be developed when they are needed in sufficient quantities.

The following information is concerned primarily with methods used to fabricate sandwich core and panels to Convair, Fort Worth, specifications. These panels range in sizes up to 3′ x 6′, and are fabricated from 17-7PH stainless steel honeycomb core and cover sheets, using 85Ag-15Mn as the brazing alloy.

Fabrication of Honeycomb Core

Honeycomb core can be made with a number of different cell configurations; the core in most common usage has square cells* and straight cell walls. This core is designated by cell size and foil thicknesses. The most common cell sizes at present are $\frac{3}{16}$″ and $\frac{1}{4}$″, but core with cell sizes up to 1″ can be made. The foil thicknesses most commonly used are 0.001, 0.0015, and 0.002″.

The foil used to fabricate core is purchased in the annealed condition and must have a maximum yield of 65,000 psi. Prior to fabricating the core, the foil is pierced to obtain vent holes (0.025″ dia) to permit atmosphere circulation during brazing and to prevent pressure rise in the panel in service.

Welded core is specified for the B-58 even though adhesive bonded core can be produced in larger amounts at lower costs. Welded core was selected because the adhesive bond is destroyed during brazing and must be replaced by brazing alloy. When the selection was made, it was believed that the flow of brazing alloy could not be controlled sufficiently to make certain that all bonds would be replaced. Also, if sufficient control of the brazing alloy were present, it would be by using additional brazing alloy that would result in a weight penalty.

Both spot and seam welding are used to fabricate honeycomb core. In spot-welded core, the welds are spaced to obtain a minimum of 20 welds per linear inch. In addition, the strength of the welds must meet certain specifications before the core is satisfactory.

Two types of honeycomb core are being produced: expanded and preformed. The core type depends on the method of manufacture.

Expanded core is produced by spot or seam welding flat sheets of foil in stacks. The welds are made across the foil in linear rows. The distance between rows controls the cell size. These stacks are built up to a thickness of about 6″. After the stacks are welded, they are slit and then expanded accordion-like, resulting in the cellular configuration. Small variations in the cell size and shape are generally found in expanded core, and it often can be recognized by these variations.

Expanded core is supplied with thickness tolerances of +0.015″ and must be machined by the customer prior to brazing. Lengths of about 20″ and widths up to 20″ are made. These dimensions are varied by splicing pieces of core together. The splices are also made by spot welding.

In producing *preformed* core, the foil is slit to the desired thickness with a tolerance of ±0.003″, and formed into half-cell shapes. These preformed strips are then spot or seam welded together, resulting in core which does not require expansion.

Preformed core has the advantage over expanded core of having a uniform cell size

*The difference in shape of square-cell core and conventional aluminum core is due to the width of the bond area. Square-cell core is fabricated by resistance welding and has square-shaped cells due to the narrow bond area, whereas conventional aluminum core is fabricated by adhesive bonding and has hexagonal-shaped cells due to the wide bond area.

which apparently is reflected by more uniform properties. Also, the core is available with thickness tolerances of ±0.003″. With these tolerances, the core does not require machining prior to brazing for panels of uniform thicknesses.

Practically all of the honeycomb core in production is fabricated from 17-7PH stainless steel. However, Types 321, 310, A-286, and AM 350 stainless steel; commercially pure titanium; and Inconel, Incoloy and Haynes Stellite 25 have proved satisfactory for core in experimental quantities.

To date, the production of core involves a high percentage of manual operations, but a number of companies are developing machines to produce cores. Some of these machines may already be in operation. It is expected that the successful application of these machines will result in better availability and lower prices for core in the future.

Fabrication of Edge Members

The fabrication of edge members requires great precision because tolerances of ±0.003″ are required. In order to meet these tolerances, manual operations often are used. However, wherever possible, normal sheet metal fabrication techniques are used in the operation.

Edge member configurations depend on the methods used to attach individual panels into the over-all structures. The configurations in most common use are Z's and U's. A drawing of edge member configurations is shown in Figure 2.

Fabrication of Sandwich Panels

Fabrication of brazed sandwich panels follows usual brazing procedures in that close tolerances and extreme cleanliness are required. It is common production practice to separate the sandwich production cores from the rest of the plant, especially the cleaning and assembly facilities which often are located in special rooms, some of which are dust free. In addition, the cleaning tanks are used only for sandwich materials and, after cleaning, all personnel that handle the parts wear clean white cotton or rubber gloves.

The core is machined to the desired shape, with tolerances of ±0.003″ to obtain good brazed joints. The machining is done with an electrolytic-type process or a hollow-ground disk-type cutter. Apparently, the electrolytic method gives a cleaner cut and better tolerances than the disk-type cutter. The ±0.003″ tolerances are met on flat panels easily, but some difficulty is encountered in machining contoured core.

During machining, the core must be well supported to obtain the precision required. To do this, the core is attached to a steel plate of the required contour by waterglass, sugar-water mixtures, or low-melting-point materials such as Cerrobend. Also, the cores are sometimes filled with water and frozen. In all cases, materials which are easily removed from the core are used. Waterglass is most commonly used and can be washed off with water. Sometimes, a white residue is noticeable after storage on core which was stabilized with waterglass. This residue can be removed by dipping the core in the following solution for 10 min:

Sulphuric acid — 20% by volume
Nitric acid — 10% by volume
Hydrofluoric acid — 2% by volume
Sodium dichromate — 1% by weight
Balance — water

In preliminary fit up, the core, edge members, and cover sheets are assembled to insure that each panel has the required tolerances. The edge members present the greatest problems, and most of the edge members are hand cut to obtain the required tolerances.

After this, all members are carefully cleaned. A typical cleaning process used is:

1. Remove mill numbers, etc., from sheets.
2. Degrease.
3. Pickle, using the following solution: Nitric acid — 6 to 7% by volume; hydrofluoric acid — 6 to 10% by volume; balance — water. The pickling solution is buffered with stainless steel and is used at temperatures of 130-150°F. A maximum pickling time of 1 min is used for edge members and cover sheets, and a 30 sec maximum dip for the core.
4. Rinse and dry.

The brazing alloy also is cleaned. Some people degrease and pickle the brazing alloy, whereas others degrease the brazing alloy but do not pickle it. Apparently, this decision is based on the condition of the brazing foil. One procedure for cleaning the brazing alloy is:

1. Degrease.
2. Pickle in 10% nitric acid solution.
3. Rinse.
4. Pickle in chromic acid solution; 16 oz chromic acid per gallon of water plus 0.16 oz of sulfuric acid.
5. Repickle in 10% nitric acid solution.
6. Rinse and dry.

If a delay of over 72 hrs occurs between pickling and brazing, all parts are recleaned. Also, cotton or rubber gloves are worn during handling to insure clean surfaces.

To insure good cleaning, the pickling baths are checked daily, and the baths are replenished as needed. The use of good cleaning procedures cannot be overemphasized since it means the difference between an acceptable or scrapped panel. Also, crevice corrosion which has been observed in these panels apparently is minimized in panels on which proper cleaning and brazing procedures are used.

Final assembly is a very critical and time-consuming operation in which the core, cover sheets, and brazing alloy are placed in a jig and tack welded together to make the panel self-supporting. Each outer core cell is very carefully tack welded to the edge members, and the edge members are tack welded to the cover sheets. Also, a wetting agent (sodium tetraborate) is applied to the brazing alloy during this operation.

Next, the assembled panels are placed in brazing fixtures called envelopes. The envelopes are box-type structures fabricated from heat-resistant metals such as stainless steel or Inconel. The length and width of the envelopes are about the same as those of the panels, and the depth of the envelopes is equal to the thickness of the panel plus the thickness of the tool that supports the panel in the envelopes. Tubes are attached to the envelopes so that they can be evacuated.

In the envelope, the panels are supported on graphite or metal tools which are machined to the shape of the panel. When graphite tools are used, the panels are separated from the graphite by thin stainless steel sheets to prevent carbon pickup.

Most people use graphite tooling for brazing sandwich. However, egg-crate-type tooling made from stainless steel is also being used. Graphite has proved very satisfactory because it maintains good dimensional tolerances and has good thermal conductivity. The life of graphite tooling is very good. One of the problems in using it is moisture pickup; poor brazing results are obtained with undried graphite. Therefore, the graphite is dried thoroughly before it is used in the brazing operation, and it is often stored in driers to minimize moisture pickup between brazing operations.

After the panels are placed in the envelopes, thermocouples are attached to the panel, and the top sheets of the envelopes are welded in place. After welding, the envelopes are placed in retorts. Usually, a blanket of fibrous insulat-

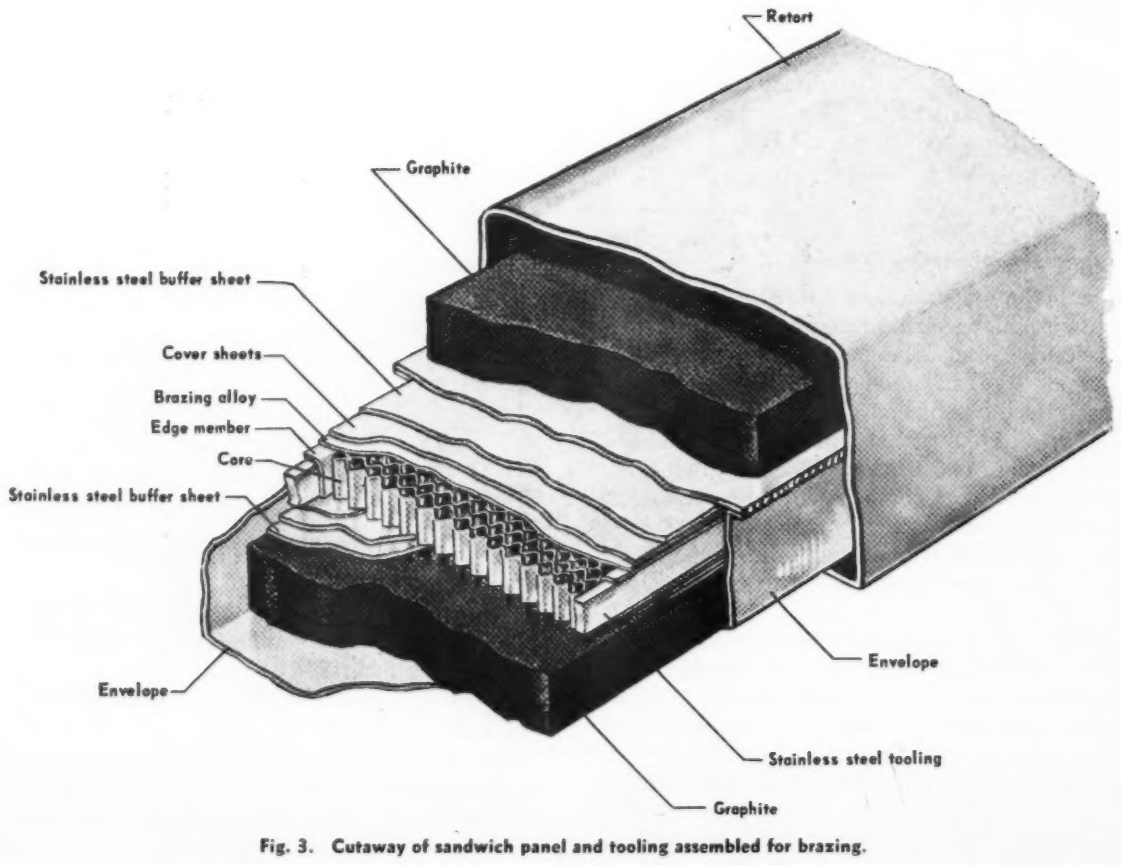


Fig. 3. Cutaway of sandwich panel and tooling assembled for brazing.

ing material or a graphite block is placed on top of the envelope to obtain uniform heating. A cross section showing a panel inside an envelope and retort is shown in Figure 3.

The envelopes are then partially evacuated. The partial evacuation causes the envelope covers to be forced against the panels due to the pressure differential. As a result, the cover sheets are pressed firmly against the brazing alloy, core, and edge members so that proper brazing tolerances are obtained. The pressure differential between the envelope and retort is about 4 psi. The factors that control the pressure differential are core crushing for facing thicknesses of 0.010″ and greater, and face indentation for facing thicknesses of 0.005 and 0.008″.

At the time the envelopes are evacuated, the retorts are purged with argon. A small hole punched in the envelope allows argon to flow into the envelope at a controlled rate. This results in an argon atmosphere in the envelope for brazing. At some installations, the envelopes are not placed in retorts, but argon is supplied directly to the envelope. The use of retorts is advantageous, however, because if the envelopes develop a large leak, the panel is not lost.

The use of a proper brazing atmosphere is extremely important. Argon, hydrogen, and mixtures of the two have been used; but, with 17-7PH core and cover sheets and the 85Ag-15Mn brazing alloy, argon has proved to be the most satisfactory.

After the envelopes are properly purged (as determined by measuring the specific gravity of the gas), the retorts are placed in the furnaces for brazing. The assemblies are brazed and heat treated in the same operation. During this operation, the heating cycle is carefully controlled and varies with panel size and shape. The retorts are heated to 1815°F ±25°, held 15 min, cooled to 1400°F, and held 1½ hrs. The retorts are then removed from the furnace and cooled to room temperature. After cooling, the panels are removed from the envelope and refrigerated at –20°F. After refrigeration, the panels are radiographed. If the radiographs show satisfactory brazed joints between the cover sheets, core, and edge members, the panels are aged at 1050°F to develop the required strengths.

The procedures used to fabricate flat, slightly contoured (i.e., maximum ordinate up to 6″), and tapered panels are fairly well established, but the fabrication of panels with greater contours curved has proved to be more difficult. Difficulties in fabricating these panels are found in (1) machining the core to required tolerances, (2) obtaining proper tooling, and (3) controlling the flow of the brazing alloy.

The filler metal tends to flow to the lowest part of the panel during brazing, and an excessive amount of brazing alloy is found in this part of the panel. This flow is attributed to the effects of gravity and non-uniform heating of the panels. A technique that has proved beneficial is to heat the panels to a temperature just below the brazing temperature, hold at this temperature until the panels are uniformly heated, then raise the temperature to the flow point of the brazing alloy for only a relatively short time to control the flow of the brazing alloy.

end

MULTI-STATION MULTI-OPERATION TRANSFER MACHINE

A new, compact, seven-station transfer machine, designed for machining gas burners prior to hole drilling, uses standard tooling and incorporates two types of standard Zagar drill heads.

The machine working stations are as follows:

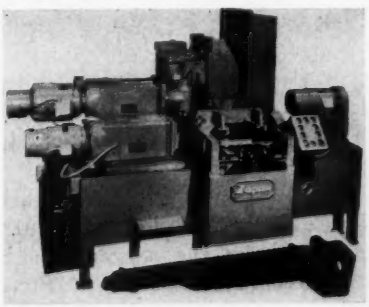
1. Two holes, one at each end of burner, are spotfaced. One is reamed and one is drilled.
2. Bottom face of flange end, face milled.
3. Two holes drilled horizontally, one hole drilled in the top by a vertically mounted drill head.
4. Holes drilled at station three are tapped.
5. Slot milling, one on each side at either end of the burner, done simultaneously.

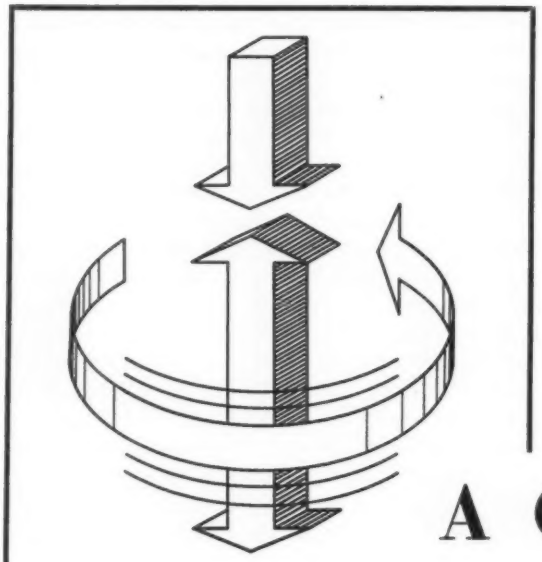
Two stations are provided for load and unload.

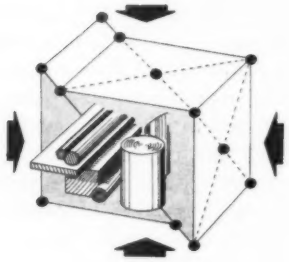
Movement of the burner from one station to another is done by transfer bar. Movement is continuous, hydraulically actuated, and interlocked.

The first, second, and fifth stations use standard Zagar cam feed drill units. The third and fourth stations have Zagar gearless drill heads. The entire installation is automatic, with opportunity to automate loading and unloading. Production is rated at 180 burners/hr at 80% efficiency.

The machine was designed and built by Zagar, Incorporated.







A Cold Answer to Some 'Hot' Metal Problems

High Temperature Alloys Can Now Be Cold Worked by New High-Impact-Spin Technique

by C. E. Ricketts
LEMERT ENGINEERING CO., INC.
Plymouth, Indiana

THE "AGE OF METALLURGY" that we have entered, under the pressure of increasing air speeds and other spectacular demands, has been full of surprises. With the creation of the super alloys, and the challenge to fabricate them, a flurry of new thought followed by experimentation has come to those involved with airframe and other like fabrication problems. Everyone has had a formidable array of obstacles in the serious business of achieving *economical superior producible* products. In the aircraft industry, *repairable* components for manned aircraft is an additional demand.

One of the most important of these problems was, and remains, the technique of fastening parts together. Until we in the United States are skilled enough to fabricate parts or complete units out of "whole cloth," much attention will be devoted to basic mechanical fastening techniques. It is thought that, even under the present accelerated progress of the joining arts, it will be between 10 and 20 years

before Industry may discontinue to any extent the basic mechanical fastening methods we now use.

Several mechanical joining techniques have had their full measure of surprises. However not as many surprises have been forthcoming elsewhere as with the radically different joining concepts in charting the way to a more or less homogeneous construction technique. The new alloys have certainly not played favorites among construction philosophies; they have shared both their promise and headache with all comers.

The common underlying problem associated with the modern temperature-stress-corrosion resistant alloys, ferrous or non-ferrous, has been the problem of heat. This has been the story from laboratory inception through the mill, and from production machine builder through the fabricator. Heat, ordinarily a help, had become a hindrance. Or more charitably, it may be said that heat was a mighty tricky partner in some metalforming practices.

The outstanding headache in the development and production use of hot-formed metals for jet aircraft skins has been their adverse reaction to heat, as used with a number of metalforming techniques which were originally developed for subsonic materials. Commercially pure titanium and half-hard stainless steel supplied only the opening "jolt" to pre-jet mechanical joining methods and processes. With these metals, a considerable number of adaptations and variations of the heat approach were tried; and, as the old 110,000 psi UTS was gradually exceeded and metals pressed on toward the 300,000 psi mark, certain basic truths became obvious. The first was that super alloys do not respond well, in general, to the use of heat as an aid to ductile forming. The second was that metals with temperamental structures would not submit peaceably to brute methods of direct force. Embrittlement, contamination, and a general strength reduction were often encountered when heat was applied to high-alloy metals; here, the very properties which had been developed at great cost and effort, were often lost.

Rupture prevention of super alloys, even of the highest tensiles contemplated or in experimental use today, must take into account all of the characteristics of the metal being worked. However, Rockwell hardness and very high tensiles are not serious factors like elongation and consequent shearing.

Cold dimpling is the best illustration of working high-alloy metals by the processes about to be described. In dimpling, any modern metal with a tendency toward brittleness has many potential causes of failure. Failures are accentuated where tight conditions exist, where small radii deformations are to precise specifications, and where there is the hazard of the work hardness approaching that of the forming tool during the process.

To achieve success the following must be avoided:

1. shearing (circumferential and radial)
2. lamination cracking
3. work-hardening or galling
4. variations in the metal's mill-structure

Material in its prime condition will have some dimensional variations. These can be handled by forming and relieving in alternate steps even when admitted imperfections are present along with an already temperamental structure.

Lemert Engineering entered this problem-area using their original Airflex machine with

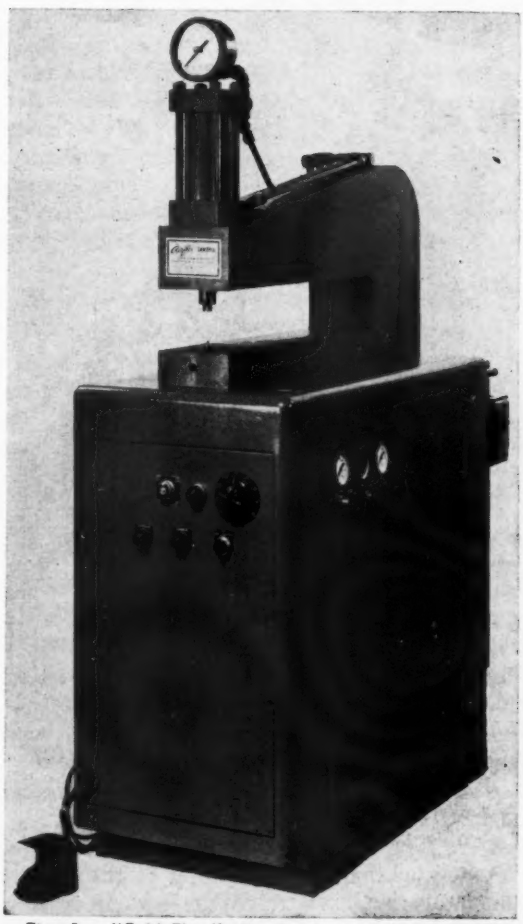


Fig. 1. "Cold-Flow" dimpler is used for the cold working of the newest high-temperature alloys, although it works softer alloys as well. Technique differs beyond standard ram cold-forming in that it combines high-frequency impacts with spinning to reform temperamental metal structures. The forming is rapid and yet by segmented radial stages necessary to prevent shearing.

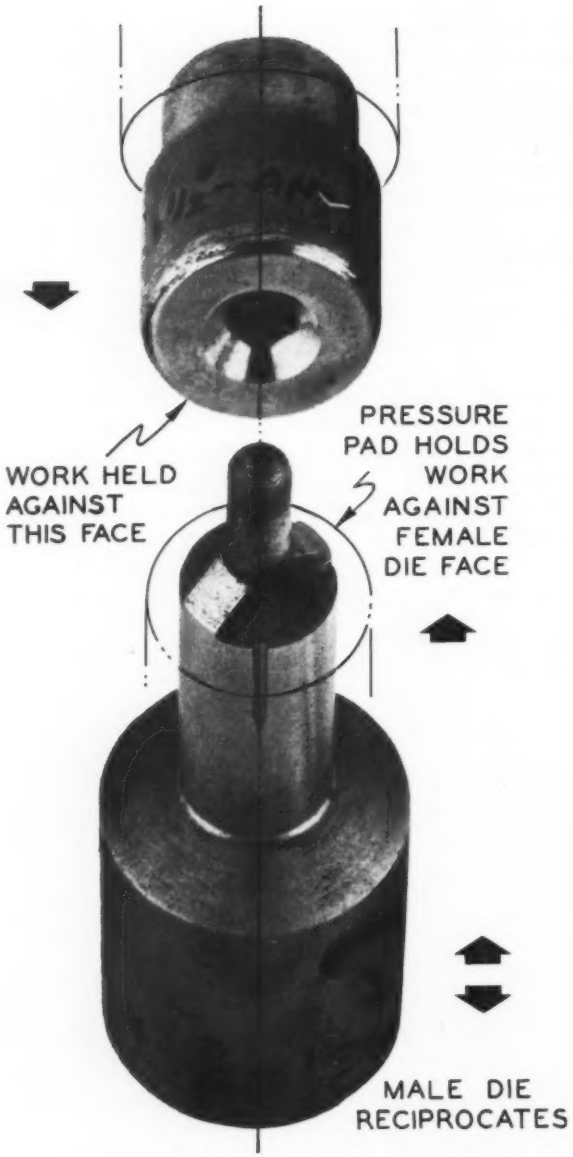


Fig. 2. The dies for this process are shown here in their respective working positions — female die above.

its high-frequency-impact, 360°-rotation design on dimpling titanium to provide a recess for a rivet head. The *experiment* was successful to the extent of revealing that this method was feasible for cold forming high-alloy metals. Also revealed was the demand for versatility of controls to harness and direct the forming power.

A new air hammer was built to fulfill this demand called "Camtrol." Camtrol was coined from "high-speed-rotary-air-cam." *As a basic premise this machine holds that hard-to-work materials can be cold worked* if certain suitable forces are properly controlled, and delivered in rapid successive stages that do not violate the time-dependent, stretch-deformation limits of a material. The method differs basically from ordinary cold forming in that two distinct processes are used together. High repetitive impacts are administered with modified spinning to reform the metal. The forming is by minute radial stages necessary to prevent excessive elongation or shearing.

The frequency-impact-spin process utilizes a female die approaching from above, that contains the configuration of the desired dimple and does not rotate. It is ram-actuated to butt firmly against the sheet to be dimpled which in turn is supported by a hollow anvil below through which the male die operates. The male die contains the pilot for maintaining the workpiece alignment with the dies and is actuated by an air-driven unit to deliver a rapid succession of hammer blows. While rotating and since it is radially segmented, the cone of the male die deforms only a small amount of metal during each blow. These slight deformations are not adjacent to each other in relation to successive blows but soon overlap and blend until the dimple completely fills the female die.

This cold-working process is a delicate one, since too much incremental deformation leads to cracking and too little deformation fails to seat the dimple in the female die. Success depends on an infinite number of control varia-

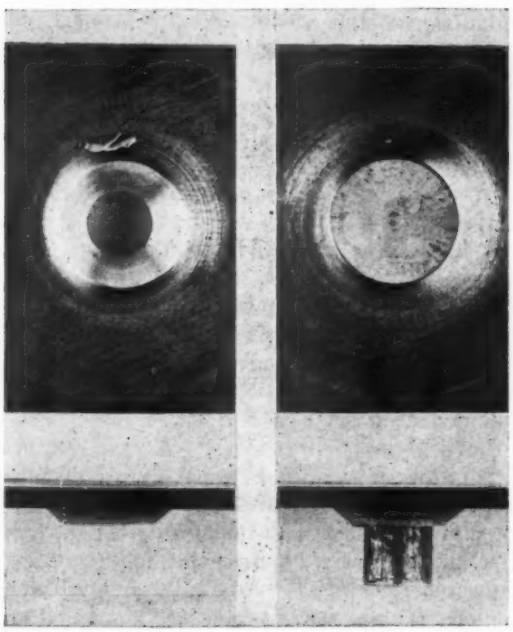


Fig. 3. Examples of dimples, one with rivet, showing the fine definition to be had by this process. It should be mentioned that the pilot holes for dimpling with this process are best prepared by piercing on the same machine.

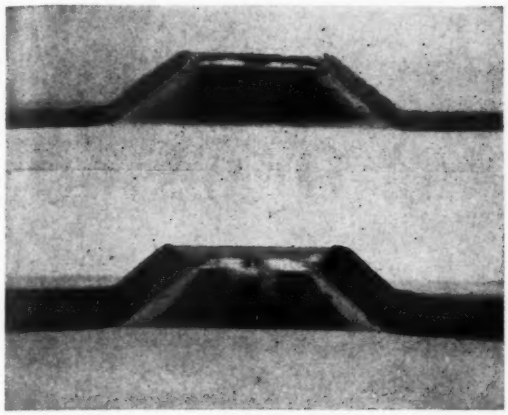


Fig. 4. Sections of dimples showing freedom from circumferential, radial, or lamination cracks. Also note uniformity of wall thickness.

tions such as: strokes per min, feed rate, cycle time, rotational speed of male die, hold down pressure and pressure delivery. Its main aim is the avoidance of exceeding stretch limits within a single cycle of machine operation.

This "Cold-Flow" process does not use heat as associated with ram type dimpling. But, even as embrittlement and annealing are serious pitfalls of heat-aided processes, workhardening and galling are drawbacks of cold-forming processes. These hazards (in this instance) are avoided by principles which allow the work to relax between forming strokes, and there is an equalization of the downward molecular centripetal flow with the upward centrifugal flow. This is made possible by control variations mentioned above.

Some experimental consideration has been given by Lemert to both preliminary heat and other preliminary treatment only to the detriment of tensile strength. Preliminary treatment was tried with the high strength, high heat-treat, low ductility materials extending from titanium (8% Mn, and 6 Al-4V) through the age or precipitation hardenable steels (17-7 PH with RH-950 heat condition) to the very new Thermold "A" (C. 300,000 psi UTS). All

TABLE 1. TYPICAL MACHINE SETTING AND CYCLE TIME FOR COLD DIMPLING

Material[1]	Thickness, inch	Time Cycle, sec.	Blows Per Min.	Hammer Press., psi	Ram Press., psi
Ti-75A	0.032	5½	80	56	1000
Ti-75A	0.040	5½	80	60	1000
Ti-75A	0.100	7	80	100	2000
Ti-140A	0.064	6	80	100	2000
6A1-4V	0.064	6	85	64	2000
6A1-4V	0.125	8½	75	100	4000
17-7PH (TH1050)	0.050	7	80	92	1000
17-7PH (RH)[2]	0.064	7	80	100	4000
17-7PH (RH)[2, 3]	0.125	8½	76	100	4000

(1) All dimples for 3/16 AN 426 rivet.
(2) Subzero transformation—detail not available.
(3) Cycle repeated to obtain satisfactory dimple in 0.125-in. material.

TABLE 2. HARDNESS OF COLD-DIMPLED SAMPLES

Material	Hardness Rockwell "C"	Thickness, inch	Type of Dimple
Ti-75A	21	0.032	3/16 AN 426
Ti-140A	30	0.064	5/32 AN 426
Ti-6A1-4V	33	0.064	3/16 AN 426
17-7PH (TH1050)	45	0.032	3/16 AN 426
17-7PH (RH condition)	47	0.064	3/16 AN 426

preliminary and/or accessory uses of hot or cold pre-stressing techniques have been taken into consideration on the most advanced experimental metals. The dual purpose behind the investigation of pre-stressing techniques was an effort to increase the opportunity for a still more favorable production time and to decrease all possible metal failure. There is some belief that *stress relieving temperatures* not to exceed 800°F* may be found suitable for super alloys approaching ultimate ranges between 300,000 to 350,000 psi.

end

*The editors believe that this temperature should be used advisedly and that consideration might be given to any temperature up to the recrystallization point of the metal in question.

Putting good holes in the alloys spoken of in the above article is difficult and expensive when done by drilling or punching methods. Actually any movement or deformation of these alloys as in piercing, riveting, tube flaring, or any other cold forming process presents the probability of undesirable structural parting. However, this process whereby metal is moved delicately (so to speak), a little at a time, can be a great aid to the cold former, now and in the future.

COMING SOON

"Staking Can Save Money in Assembly"

"The Acceptability of Screw Threads"

"Special Report on Diamond Use and Conservation"

"A New Approach to Milling Steel with Carbides"

"Optical Jig Boring for Greater Accuracy"

A High-Precision Lathe Headstock

by L. M. Leblans

A unique high precision spindle and vibration-free drive which should be of extreme interest to development and prototype shop engineers in the fields of optics, electronics, measuring instruments and gages.

LATHES FOR MACHINING with high precision in directions perpendicular to the axis of rotation (radial) are generally available. On special toolroom lathes shafts may be turned to a diameter tolerance of a few microns, whilst local surface roughness may even be reduced to e.g. ½μ.

From Philips Tech. Review, Vol. 19, 68-69, 1957/1958, No. 2. A publication of the Research Laboratories of N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands.

Whenever a lathe is used to machine flats or profiles on end surfaces, e.g. facing plastic lenses, we are concerned with the accuracy in a direction parallel to the axis. This accuracy, which is not very critical for ordinary applications, is mainly dependent upon the thrust bearings of the lathe spindle.

With other machine tools, such as grinding and drilling machines, it may also occur that

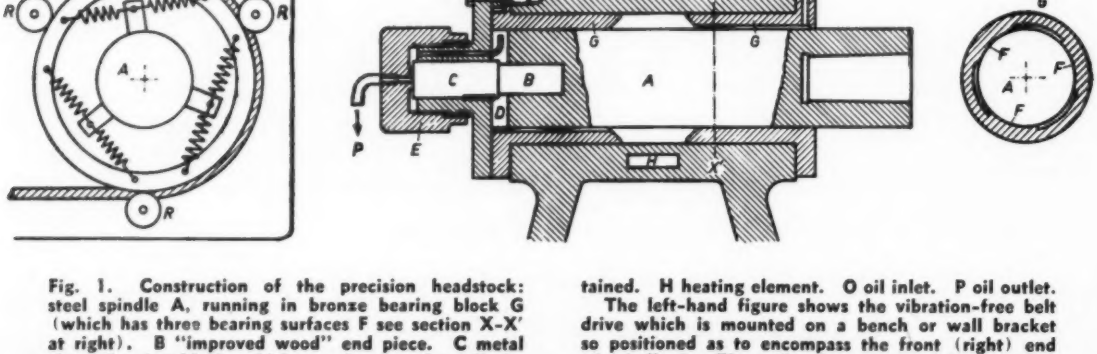


Fig. 1. Construction of the precision headstock: steel spindle A, running in bronze bearing block G (which has three bearing surfaces F see section X-X' at right). B "improved wood" end piece. C metal thrust bearing block, which may be moved axially by means of the micrometer screw E. In the space D a constant pressure, beneath atmospheric, is maintained. H heating element. O oil inlet. P oil outlet.

The left-hand figure shows the vibration-free belt drive which is mounted on a bench or wall bracket so positioned as to encompass the front (right) end of spindle A. The pulley S is supported by the three rollers R independent of the spindle, and drives the spindle via the six springs as shown.

for obtaining extremely smooth surfaces a highly accurate thrust bearing is desired. Adequate results for this purpose may be reached with conical slide-bearings, but a fairly large tolerance must be observed to allow for changing loads. Clearly this affects the accuracy that can be attained. A bearing free of this drawback and ensuring a very high degree of axial and radial accuracy has been developed in the Eindhoven Research Laboratories. Its construction is shown in Figure 1. The end of the main spindle, which is accurately supported in radial direction by the bearing, is fitted with a piece of "improved wood"[1]. This wooden member rests against a stationary metal thrust block, whose front surface has been lapped plane and perpendicular to the main spindle A with a high degree of accuracy. The main spindle is pressed against the thrust block with a constant force, owing to the fact that a constant pressure below atmospheric pressure is maintained in the closed compartment D in which this contact takes place. The thrust block can be axially displaced by means of a micrometer screw. In this way the workpiece on the main spindle can be displaced over an extremely small distance (the cutting depth) with respect to the tool.

Obviously the position of the tool in axial direction must be fixed with great precision as well, but this requirement can be readily satisfied.

The low pressure in the above compartment also sucks in an ample flow of oil along the main spindle, so that the latter is efficiently lubricated, which is necessary for a very accurate radial support. Both the steel spindle and the three supporting surfaces (F in Figure 1) of the bronze bearing block have been accurately lapped to size with a tolerance of only about 1μ. This means that a temperature drop of 5°C would cause the spindle to seize because of the difference in coefficient of expansion between the two materials. This is avoided by keeping the whole bearing at a constant temperature of about 30°C with a heating element. The enforced oil-flow prevents any excessive local overheating of the sliding surfaces, which would increase the play.

The spindle should be driven with the greatest uniformity, avoiding any vibrations in the drive. The pulley is therefore not fitted rigidly to the spindle, but coupled to it via steel springs, the pulley being supported not by the spindle bearing, but on rollers of its own.

The axial accuracy attainable with this construction can be deduced from Figure 2, a photomicrograph of the surface of a flat disc machined on a lathe equipped with the headstock in question. A diamond-tipped tool was used with a round tip of radius 200μ. The lateral displacement of the tool (cross feed) was 9μ per revolution. The finished surface thus consists of adjacent grooves 9μ wide and with a depth of $4.5^2/(2\times200) = 1/20\mu$. A close examination of the photo shows that the width of the groove never varies by more than about 5%. This means that during a short period (the machining of the area shown in the picture lasted about 5 seconds) the axial displacement of the lathe spindle relative to the tool did not amount to more than 10% of the groove depth, i.e. less than $1/200\mu$.

Fig. 2. Photomicrograph (250 X) of the surface of a disc of plastic material machined flat with a diamond tool on a lathe equipped with the vibration-free, precision headstock described in the text. From the uniformity of the groove width, it can be deduced that spindle movement in the axial direction during working was less than 1/200 micron.

The same lathe was used for machining a cavity resonator for 8.75 cm wavelength, earlier described in this Review[2], for high-precision measurements of the dielectric losses in solids. It was essential to keep local unevenness of wall, bottom and cover of the cavity as small as possible with respect to the penetration depth of the H.F. currents, viz. about 1μ for the wavelength in question. Measurements of the quality factor of the cavity resonator confirmed that the unevenness of the machined surfaces was indeed very small with respect to the penetration depth.

This lathe is now also in use for making the aspherical Schmidt correction plates of mirror cameras for X-ray fluorography[3].

end

(1) "Improved wood" is wood exposed to high temperatures in a vessel under high pressure; it is commercially available under the name "Lignostone."

(2) M. Gevers, Measuring the dielectric constant and the loss angle of solids at 3000Mc/s, Philips Tech. Rev. 13, 61-70, 1951/52.

(3) Philips Tech. Rev. 13, 269-281, 1951/52. For manufacturing the correction plates of smaller Schmidt systems (e.g. for projection TV sets), a simpler method has been developed; see Philips Tech. Rev. 9, 349-356, 1947/48.

What Makes Precision Spindles Precision Spindles?

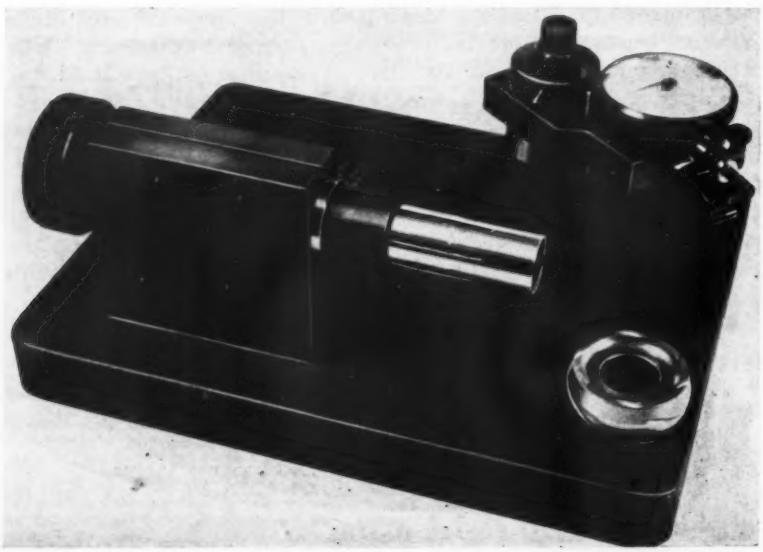
by E. Willard Pennington

Editor

ACCURACY OF POSITIONING is the outstanding specification to be met in precision workshop methods. It applies right across the board, whether we are considering a workpiece holding fixture, a workpiece inspection fixture, or the tool that works on a workpiece.

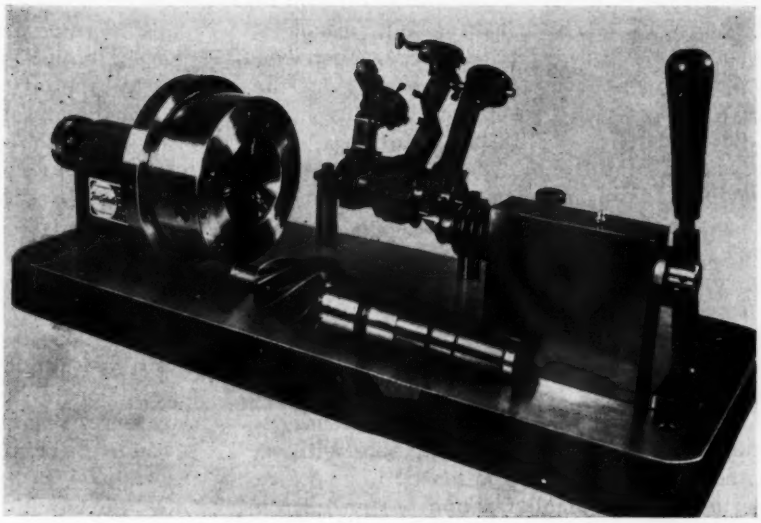
If an object has full freedom of motion, there can be no accuracy of positioning. To the extent that we can restrain its freedom of motion we approach accuracy of positioning. The maximum number of completely distinct movements that a totally unrestrained object has is six, i.e., it is free to move in a north and/or south direction in a horizontal plane, it is free to move in a west and/or east direction in a horizontal plane, and it is free to move in an up and/or down direction in a vertical plane; further, it is free to rotate about a vertical axis, it is free to rotate about a horizontal north-south axis, and it is free to rotate about a horizontal east-west axis. There are the six completely distinct freedoms of motion as defined by three mutually perpendicular planes, and three mutually perpendicular axes. Consequently, no accuracy of positioning.

Now, let us consider the loss of freedoms of motion (and gain in accuracy of positioning) represented by a cylindrical bar resting horizontally in two v-blocks with its axis lying in an east/west direction. It has lost its freedom to move north and/or south in the horizontal plane, it has lost its freedom to move up and/or down in a vertical plane, it has lost its freedom to rotate about a horizontal north-south axis, and it has lost its freedom to rotate about a vertical axis.



This workpiece is a steering gear part. Its end face has to be square with the bore within very close limits. To make this check the Woodworth zero spindle is fitted with an inspection type diaphragm arbor which locates the workpiece on exact center even if the hole is slightly tapered or out of round.

With the workpiece located on the arbor, the indicator is swung into position and by rotating the knurled hand wheel of the zero spindle a reading is obtained of face squareness to bore.



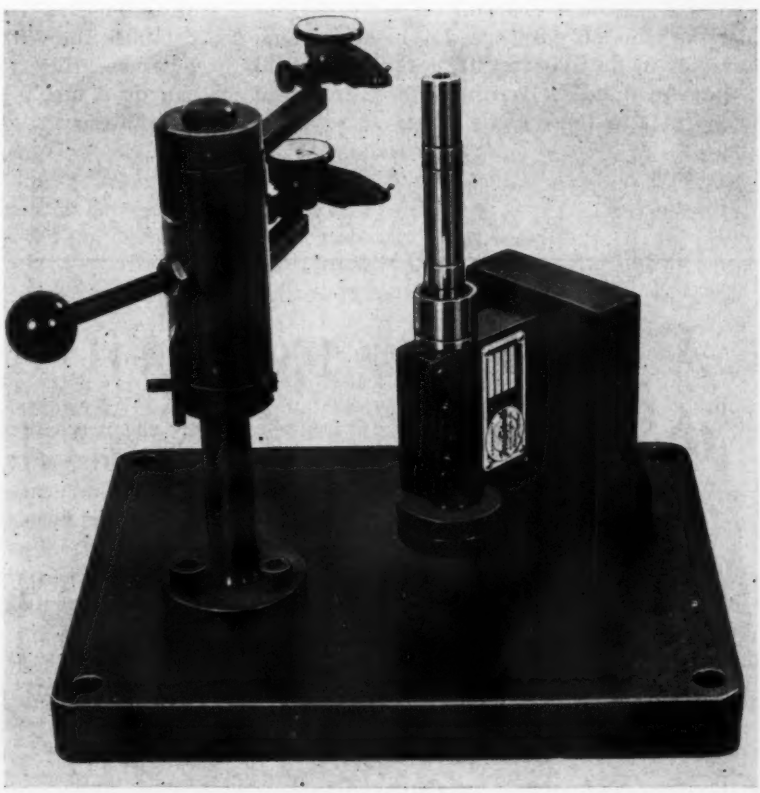
This pinion inspection setup combines a zero spindle fixture with a Woodworth bevel pinion chuck. The pinion chuck has an adjustable backplate which allows the chuck to be trued up on the zero spindle. Thus the chuck rotates on a true-center within 0.0001".

The workpiece is loaded in the chuck and the tailstock center is then located in the stem end of the pinion. When the three indicators are lowered into working position, the spindle is rotated and three separate surfaces are checked at one time, for concentricity and squareness to the pitch line of the pinion.

And what's left? Its freedom to rotate within the v's about its own horizontal east/west axis and its freedom to move (slide in the v's) east and/or west in a horizontal plane. Now, if we restrain the latter motion, i.e., any east-west longitudinal travel or end-play, we have left only one freedom of motion for the cylindrical bar, i.e., freedom of rotation about its own longitudinal axis. And the resultant accuracy of positioning (in rotational increments) is simply a function of how truly cylindrical the cylindrical bar is.

By modern precision methods, it is not too difficult to attain a cylindrical surface "dead on" in accuracy of concentricity with its own axis of rotation.

This thinking along the lines of the kinetics of design was sparked by the article in this issue describing the high-precision lathe headstock designed by L. M. Leblans of Eindhoven,



When the workpiece is unduly heavy or is extra long in proportion to bore diameter, the zero spindle can be used in a vertical position. Such setups, involving an arbor which eliminates bore tolerance in the workpiece plus the zero spindle's capability of zeroing all runout errors, give assurance of less than 0.0001" total indicator reading of runout when checked with a master part. In this application both are brought into contact by means of the swing arms and handle.

Netherlands. And it, in turn, reminded us of a precision "zero spindle" for concentricity checking which we saw in the shops of the N. A. Woodworth Company in Detroit.

Ordinarily, one would not think of a high-precision lathe spindle used at high rpm's as having much in common with a concentricity checking spindle which is manually rotated but a few degrees at a time. What they have in common is the highest attainable degree of concentricity in their one and only freedom of rotation, and full restraint as to movement in a horizontal direction, or an irreducible minimum of end-play.

In the case of M. Leblan's design he has attained this to the extent of being able, with his lathe, to do a facing job in plastic to a surface perfection of a small fraction of one micron (0.0003937″); and the Woodworth zero spindle permits the checking of workpieces for true concentricity, i.e., there is no contamination of the reading by an eccentricity of the spindle because the spindle is truly cylindrical and concentric with its own geometrical axis.

This is further insured by the zero spindle being restrained in its rotational freedom by a three-contact bearing in the body of the fixture.

Where the Leblans high speed lathe spindle is restrained from end-play by operating in a chamber kept below atmospheric pressure, the Woodworth spindle is spring loaded to accomplish the same purpose; speed of rotation being no factor in the Woodworth design. The end of the zero spindle's bearing is faced to a true 90° normal to the spindle's axis of rotation. Thus the spindle's theoretical six possible freedoms of motion have been reduced to one only, that of rotation. Thus each and any point on the spindle and its equally accurate face plate describes, as the spindle is rotated through any increment of a revolution, an arc which lies in a plane 90° to the axis of revolution.

With this true, "dead on" condition to start with, workpieces mounted on the spindle can be checked as to concentricity and the squareness of internal and external faces with the axis of rotation.

It is the simplicity of the Woodworth design, elimination of bearing errors, that insures a true "zero" reading on a master part. Thus, as successive workpieces are substituted for the master part, any dial indicator readings which show a deviation from zero have to be due to eccentricity or lack of squareness originating with the workpiece.

Tool and gage designers too often lose appreciation of the fact that accuracy and simplicity go hand-in-hand. Simplicity means lack of variables, and to the extent that variables are eliminated accuracy is enhanced.

As far as constructional and geometric simplicity is concerned, what can be simpler in the way of a one-inch measure than the two plane, parallel, and wear-resistant outside surfaces that are separated by the steel body of a Jo-block? By this same purity and simplicity of design, the Woodworth zero spindle can accomplish round-the-work measurements of Jo-block accuracy, and the Leblans lathe spindle can do a facing job to 1/200 of a micron in smoothness.

end

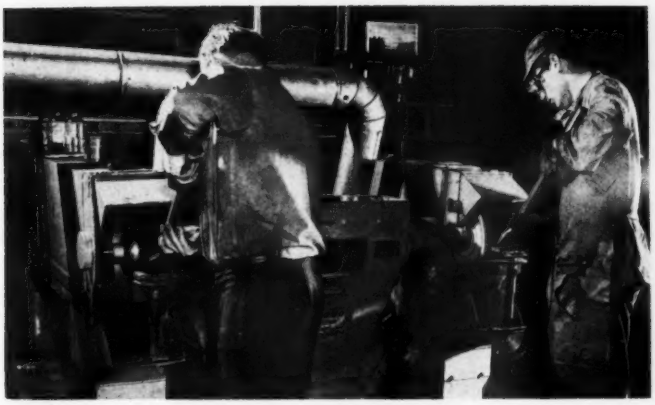
A FABLE FOR OUR TIMES

ONCE upon a time there was a man who bought a new car. Unfortunately it turned out to be six inches wider than his garage. Undismayed he attempted to drive it in and the result was of course two mangled fenders and broken headlights.

He took the car to the dealer for repairs and upon its return, tried it again. Three tries, and he was picked up by white-coated men.

Psychiatric examination revealed that he was an Industrial Engineer, and that the first symptom of his strange disorder had been an insistence on putting jobs with a 0.001″ tolerance on machines with 0.002″ capability.

Editor's note: Re credit, we stole this from Ralph Nottingham of Brush Electronics. We don't know where he stole it!—E.W.P.



Factors that Affect

THE PERFORMANCE OF COATED ABRASIVES

An Interview With
S. L. Johnson
Manager, New Methods Development
Coated Abrasives & Related Products Division
MINNESOTA MINING AND MANUFACTURING COMPANY
St. Paul, Minnesota

Mr. Johnson, in your work as a methods development engineer, you've had an opportunity to see abrasives in all forms used in many types of plants. Just how widely applicable are coated abrasives in today's industrial picture?

Coated abrasives are about as versatile as a safety pin. They will work with all materials — metal, glass, wood, plastics, rubber or what have you — and you can bend, poke, twist, push or pull them into almost any corner that needs to be ground or finished. If an accessible area can't be ground or polished with coated abrasives, it can't be done. And that includes everything from hypodermic needles to Sherman tanks.

You mean to say that coated abrasives can take the place of all other grinding and finishing mediums?

Yes! And profitably, too. Operations that were marginal with coated abrasives as little as a year ago, are now being done at a profit.

How come?

Well, first of all, a large number of people are discovering for the first time the almost limitless variations of the product . . . and they are learning how to apply coated abrasives more economically than ever before. Secondly, if coated abrasives are versatile in their application, there is certainly versatility in product design — bondings, backings, minerals, coating and curing techniques, splices, and built-in and active chemicals that minimize premature galling and dulling.

Coated abrasives, then, have come a long way since the days when . . .

They certainly have. I remember when we first started grinding and polishing forged hammers. Unit cost per hundred hammers ground that first year was three times what it is today. The machine method has changed little on this particular operation, but the coated abrasive belt has undergone a real revolution . . . particularly as concerns the bonding and the method of applying the mineral to the backing.

Since we're on the subject, what's the best way to get the longest possible life from an abrasive belt?

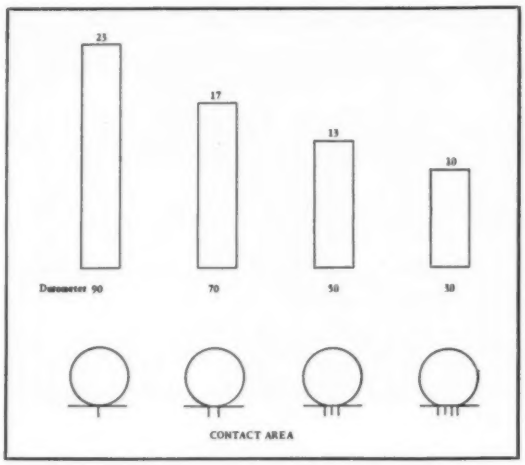


Chart I. Effect of Contact Wheel Hardness on RMS Finish with Abrasive Belts

By "longest life" I assume you mean the greatest productivity, since very often the abrasive cost is a negligible part of the operation. First of all, we have to recognize that because the mineral is on a flexible backing, and because the mineral particles are oriented for sharpness and disposed as to height for continued cut, that extremes of pressure should be avoided. And when extreme pressure is essential, a coolant-lubricant should be used to take some of the gaff.

We should be talking, then, about "productive" belt life?

Yes. In belt form, coated abrasives are the coolest cutting grinding medium there is, so they can be run faster and produce more in a given time. Limits to effective belt life are determined by several factors we can talk about later. But if one is aware that up to 70% of the life of a coated abrasive belt is accomplished with minimum pressure, then these factors can be easily recognized and integrated.

What are these other factors?

The type of metal, grit size and diameter of contact wheel. Others are flexibility of the coated abrasive, hardness of the contact wheel, coolant, horsepower, belt and spindle speeds, chip clearance, and even more.

Some of these are, I take it, more important than others?

That's right. Grit size and hardness of contact wheel are very basic. And just as important are speed, type of contact wheel and its size, lubrication, grinding pressure, belt tension and type of mineral.

That all sounds pretty complicated.

It isn't really, when you consider that all of these factors are interrelated, and there are some constants to use as guides.

What are some of these constants?

Well, one example is that softer contact wheels produce a finer finish than harder contact wheels, assuming the same grit belt. Chart 1 indicates that where a 90-durometer contact wheel produces an rms of 23, a 30-durometer wheel yields an rms of 10 for a given grit. These readings were taken at the so-called "plateau" of the graph, where the rms readings vary very little. This plateau can account for up to 70% of the belt life.

What does RMS mean?

It stands for root-mean-square. An rms reading is actually a measurement (in millionths of an inch) of peak-to-valley variance, weighted toward the deeper scratches.

What's the best way to determine the type of belt for a given job?

The first consideration is the type of operation; that is, whether it's stock removal, finishing or polishing. Then, determine the type of finish the workpiece is to receive ultimately. If the piece will be painted, for example, the final grit will be in the 100 to 150 range; but if plating is the end finish, the metal is usually oiled out with grits in the 180 to 400 range, depending on the type of plate — that is, whether it's copper, nickel or steel buffed.

How do you select a bond and backing combination?

The type of bond and backing are also dependent on the operation. Where intense frictional heat will be generated, a Resinite or Resin Bond construction is used on a cloth backing. For cooler running operations, where pressures may be light, a glue or glue-and-filler bond and a paper backing will suffice. Flexibility is also a factor, remembering that the tougher the bond and the heavier the backing, the less flexibility there will be. A rule of thumb is to use the most rigid construction possible, assuming other factors have been satisfied.

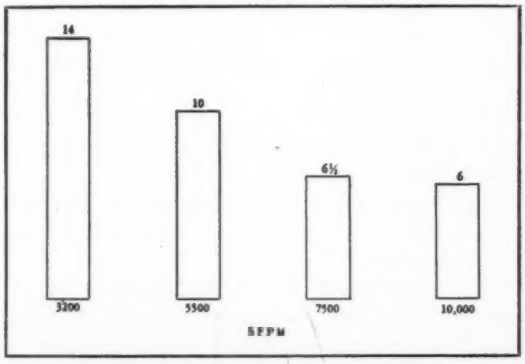


Chart II. Effect of Abrasive Belt SFPM on RMS Finish

It seems to me you mentioned speed as being important in obtaining a desired finish.

True. One of the big advantages of the coated abrasives system is that operating speeds are higher than they are for other methods, offering a faster cut. Belt speeds are measured in surface feet per minute (sfpm) and are based on the spindle's rpm in relation to the size of the contact wheel. Speeds measured in sfpm range all the way up to 10,000 and are dependent, among other things, on the condition of the machine.

How does speed affect finish?

Well, the easiest way to illustrate this point is to chart the results of a test run with all factors (contact wheel hardness and size, grit, workpiece, pressure, etc.) constant except for speed, as illustrated in Chart 2. Since a speed of 3200 sfpm produced an rms reading of 14 — and there is an inverse ratio between speed and rms reading down to where a speed of 10,000 sfpm produces an rms of 6 — we can assume that higher speeds result in finer finishes. The rms changes little over speeds of 7500 sfpm.

You mentioned contact wheel size as a constant factor in the above illustration. Does this size have any bearing on finish?

Yes it does, to the extent that everything else remaining constant, a larger diameter contact wheel will produce a lower rms reading than a contact wheel of smaller diameter. This is because on a large wheel the pressure exerted by the workpiece is spread over a larger area, so the pressure per square inch becomes less than with a small wheel. Less unit pressure gives a finer finish.

Does that indicate that wheel hardness plays a part in finish?

Yes, and for about the same reason that a larger wheel gives a finer finish, so does a softer wheel. Again with all things being equal except the durometer of the contact wheel, as Chart 1 shows, a 90-durometer wheel produces a 23 rms reading and the 30-durometer produces 10 rms. It should be noted, however, that harder wheels and/or small diameter wheels produce a shorter, narrower scratch pattern, and one that is not deformed by a chip smothered in the contact area.

Why is a contact wheel so important to abrasive belt performance?

Except for free-of-belt and semi-supported strapping operations, something must support the belt. On some types of machines, support is supplied by a platen. But in the majority of cases, it is the contact wheel that lends the support, and the action of the wheel governs the action and effective penetration of the individual mineral grains on the belt. A contact wheel with a serrated face, for instance, has a different effect on the mineral than does a plain face wheel. Chart 3 illustrates this point very well.

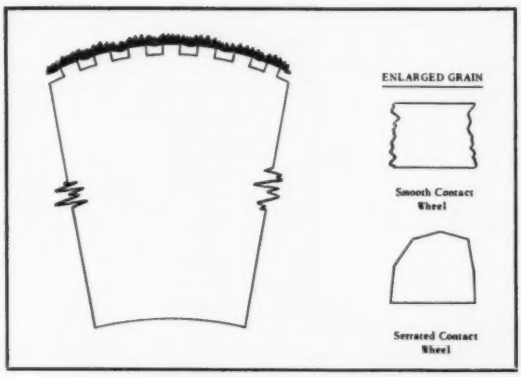


Chart III. Effect of Contact Wheel Serration on Mineral Wear

Does a serrated or slotted wheel make the belt wear faster?

On the contrary, it actually lengthens effective belt life in many cases. Slotting the contact wheel has the unique effect of sharpening the mineral grains as they undulate over the face of the wheel. A plain face wheel puts all the wear on one plane on the mineral, and gives it a flat surface. Remember, though, that slotting is a secondary factor in selection of a wheel and coated abrasive. The first consideration is the productive result of the workpiece — not belt life.

There are two types of contact wheels, I gather — plain face and serrated.

With some notable exceptions that's right, but there are many types of serrations. When a wheel is slotted, lands and grooves are produced. The "lands" are the raised strips between the grooves, on which the belt rides. The relationship between the lands and the grooves, and the angle at which they cross the face of the wheel, determine to a great extent the aggressiveness of the wheel. Aggressiveness is further determined by durometer, or hardness.

You lost me on the lands and grooves.

Take a look at Chart 4. This gives rms readings where everything was constant except the type of wheel. The reason why the "Serr-X" wheel and the scoop produce rougher finishes (higher rms readings) is that when you widen the grooves you increase unit pressure and permit a deeper scratch pattern.

Where does hardness fit into the picture?

Because rubber, like water, is noncompressible, when you push on one spot it bulges

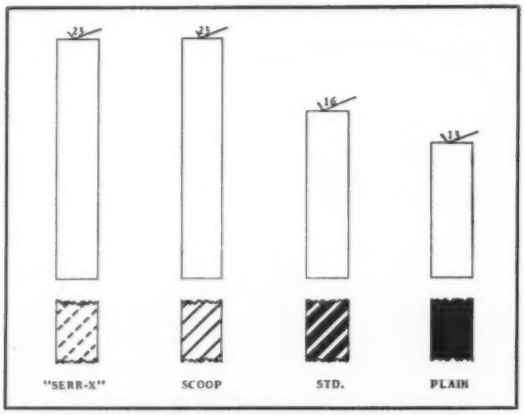


Chart IV. Effect of Contact Wheel Serrations on RMS Finish with Abrasive Belts

somewhere else. In slotting, the rubber land can distort into a void, or some types actually fold over to some extent. Since this increases resilience and conformability, and lowers the functional hardness of the wheel, slotted wheels should have a durometer 10 to 30 points harder than the durometer of a plain face wheel for a given application. We have developed some rather interesting procedures to test the functional hardness of wheels to accurately gauge their dynamic resilience at operating speed.

Somewhere along the line you mentioned the angle of the serration across the face of the contact wheel. What effect has this?

The angle of the slot is measured as 90° being straight across the face of the wheel. The other extreme would be a 7° angle, something like a screw thread. Some different angles are illustrated in Chart 5. The lower the angle toward 15° or 7°, the finer the finish and the lower the rms reading. Slot angles of 30° or less are usually employed in the polishing operation. The 90°, for all its progressive impact action, often makes a siren-like sound and frequently leaves a pattern in the work. The 45° angle is the largest one that will run relatively quietly in an average backstand operation.

What, exactly, is the mechanical process for lowering a high RMS reading?

Well, the coarse grit belt was used to remove stock, and thereafter substantially little change will be made in the gauge of the metal, as measured from the bottom of the deep, coarse belt scratches. Rms is reduced by cutting off the tops of the ridges between the deep scratches. We've run some tests along this line to determine the amount of stock removal required to effect a given change in rms reading. From these tests has come a formula, as illustrated in Chart 6.

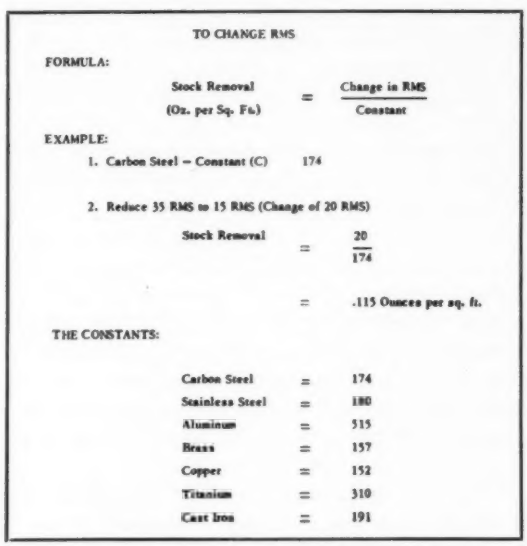

TO CHANGE RMS
FORMULA:
Stock Removal (Oz. per Sq. Ft.) = Change in RMS / Constant
EXAMPLE:
1. Carbon Steel – Constant (C) 174
2. Reduce 35 RMS to 15 RMS (Change of 20 RMS)
Stock Removal = 20/174
= .115 Ounces per sq. ft.
THE CONSTANTS:
Carbon Steel = 174
Stainless Steel = 180
Aluminum = 515
Brass = 157
Copper = 152
Titanium = 310
Cast Iron = 191

Chart VI. Determining Amount of Stock Removal

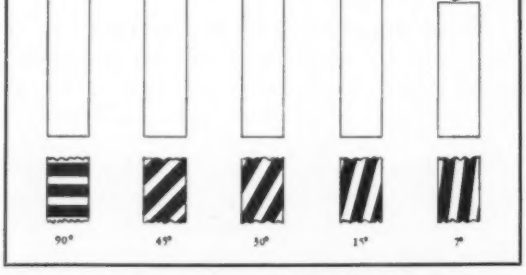


Chart V. Effect of Contact Wheel Serration Angle on RMS Finish with Abrasive Belts

This seems like a pretty complex business, Mr. Johnson. Don't all these variables make it rather difficult to set up a grinding and finishing line with coated abrasives?

The system is not so complex as it might seem, since many of the factors are interrelated, as I mentioned before. All of them are based on common sense use of the product. Coated abrasives today have more to offer in economy, speed, consistency and safety than any other grinding and finishing method. Improvements are continually being made, and new products, methods and machines are always under development. It's safe to say that it won't be too long before coated abrasives will be the first consideration of the production or tool engineer.

end

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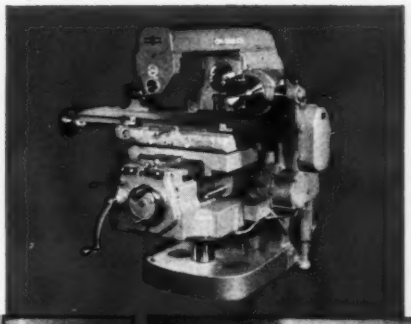

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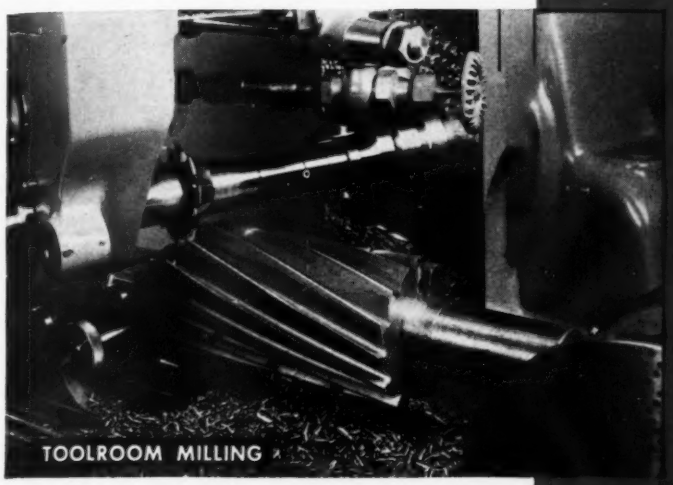

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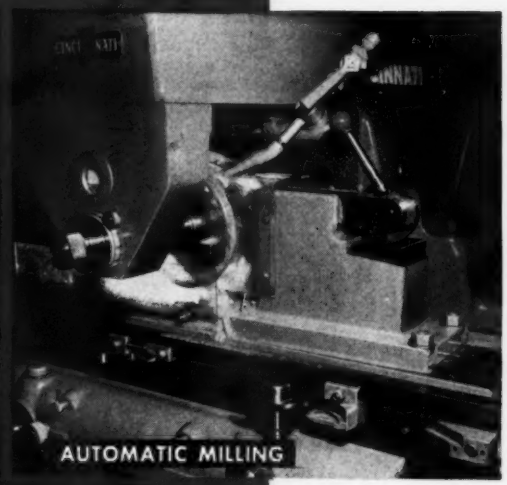

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DIAL TYPES for Automatic Milling

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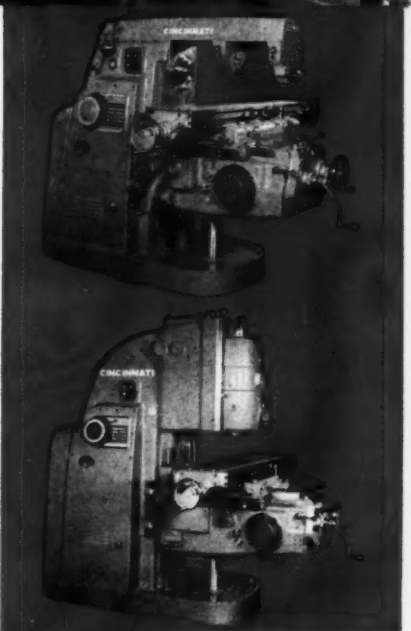

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	Universal			no
	Vertical			yes
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	Universal			no
	Vertical			yes
No. 4	Plain	42"	20 hp	yes
	Universal			no
	Vertical			yes

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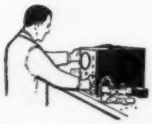

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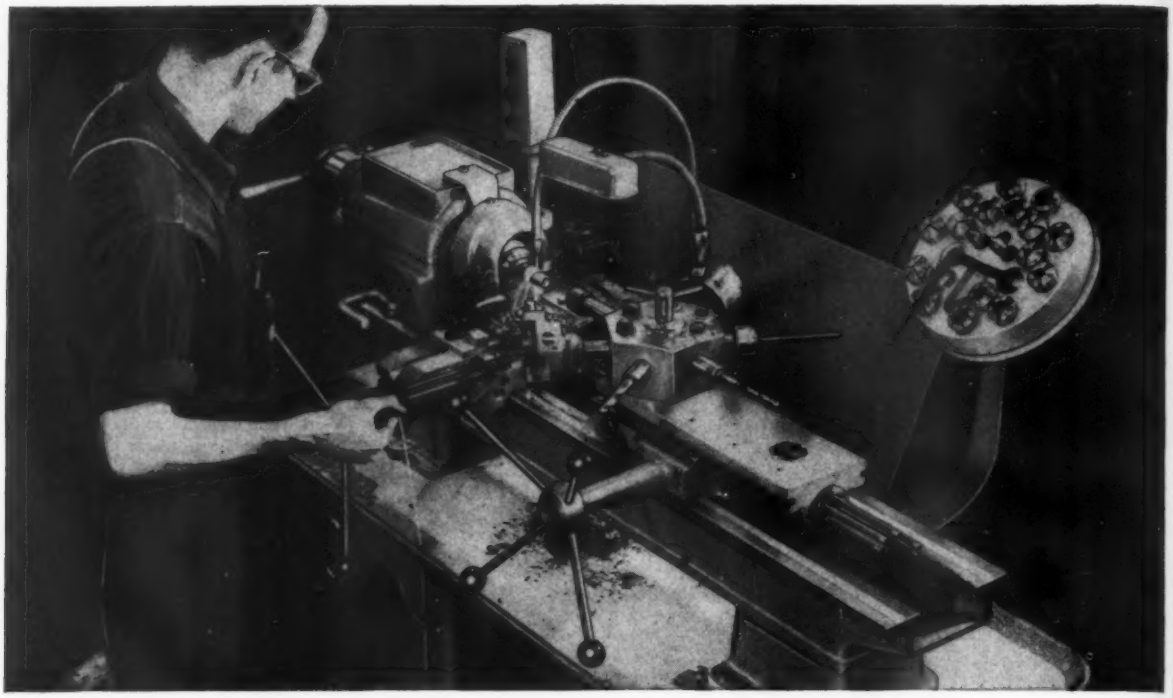

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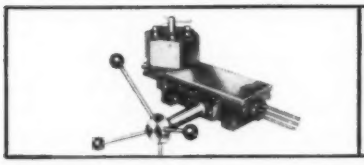

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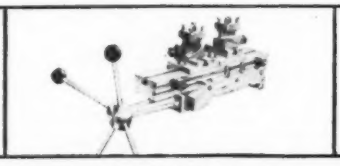

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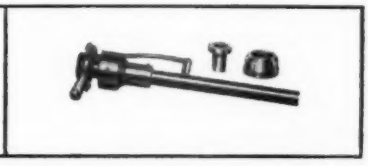

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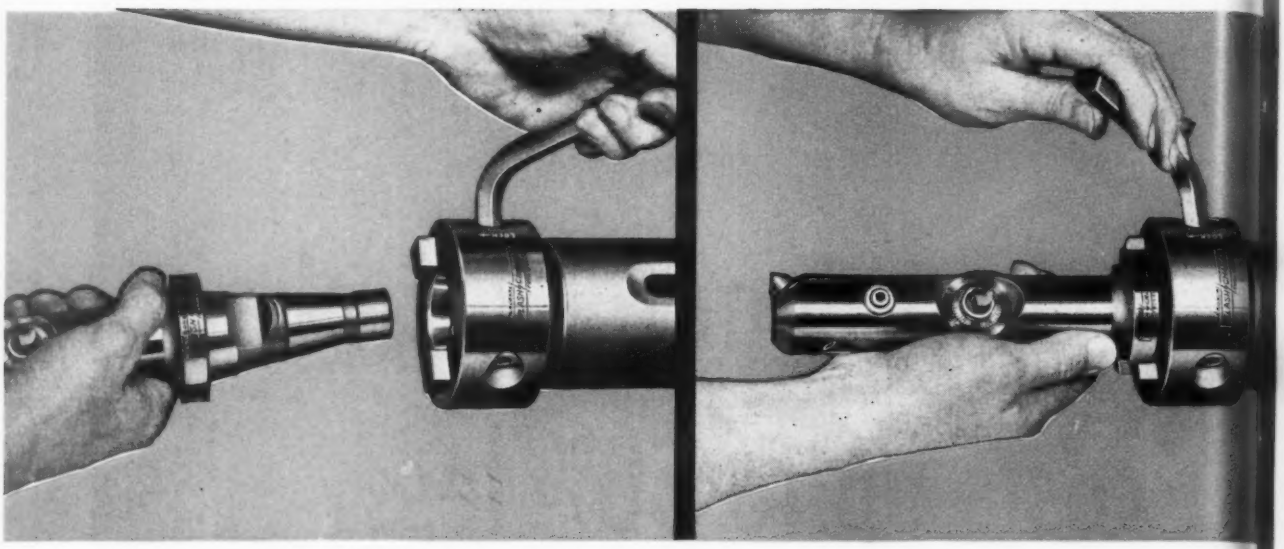

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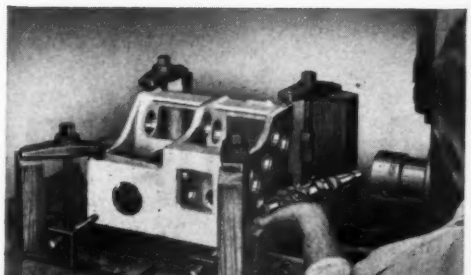

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How costs are cut when inspection speed matches assembly rate

Electronic Tube Division, Burroughs Corporation, faced this problem: Find a way for inspection to keep up with assembly in the mass production of the Magnetron Beam Switching Tube. The answer: Optical gaging with a Kodak Contour Projector.

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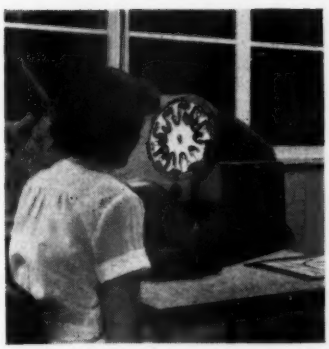
Fast, accurate optical gaging of the Magnetron Beam Switching Tube means a substantial saving for Burroughs. Electronic devices of this type are expensive to make. When tube elements are inspected immediately after assembly, imperfect units can be rejected with relatively small expense.

If you have an inspection problem that requires a high-speed, low-cost answer, a Kodak Contour Projector may well fill the bill. Send for the booklet "Projection Gaging with Kodak Contour Projectors." Write to:



Operator working with a Kodak Contour Projector, Model 8, can quickly read measurements down to .001". Visual inspection easily keeps pace with top assembly speed.

Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

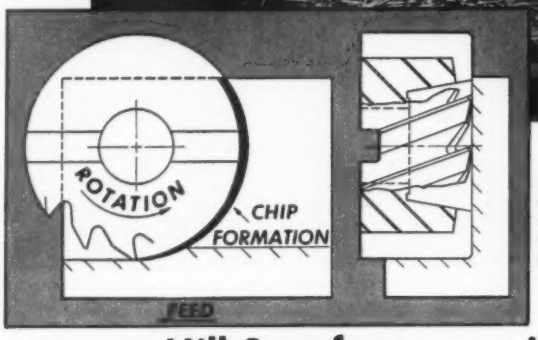
the KODAK CONTOUR PROJECTOR

Kodak

CIRCLE INFORM-A-GRAM KEY NO. 97

Brown & Sharpe – NELCO *A Tremendous Tooling Team!*

Cutter Design Pays off in Chip Size... Shape!



In shell milling, the chip is thin where tooth enters, and thickest where tooth leaves the work. Cutter is designed to roll chips produced parallel to axis of cutter.

Mill 2 surfaces... with 1 High Speed Steel Cutter

You can often save time and money by machining two surfaces at once with one shell end mill. But this milling economy is impossible without an accurate, rigid cutter capable of producing a good finish on both work surfaces.

A correctly designed cutter will make the long continuous chip shown here, giving a cooler running cutter and a superior surface finish. Brown & Sharpe Shell End Mills are PRODUCTIONEERED with correct rake angles and precision ground chamfered edges—for smoother chip flow, longer cutter life.

Don't let "almost-as-good" high speed steel cutters steal your milling profits! For top performance, economy and reliability, always specify Brown & Sharpe PRODUCTIONEERED Cutters.

B·S *Write for new 96 page Brown & Sharpe Catalog showing over 2300 High Speed Steel Tools and Accessories.*

BUY THROUGH YOUR LOCAL DISTRIBUTOR

Brown & Sharpe

PRECISION TOOLS AND GAGES • MILLING, GRINDING AND SCREW MACHINES
CUTTERS • MACHINE TOOL ACCESSORIES • GEAR, VANE AND CENTRIFUGAL PUMPS

BROWN & SHARPE MFG. CO. • PROVIDENCE 1, RHODE ISLAND

CIRCLE INFORM-A-GRAM KEY NO. 98

District sales engineer of the Giddings & Lewis Machine Tool Co., **Herbert A. Andresen** and **John C. Stateson,** has been assigned to the Eastern district. Working out of the New York office, Mr. Andresen is a sales specialist for the Davis Boring Tool Division's product lines while Mr. Stateson represents the Cincinnati Bickford and Kaukauna Machine & Foundry Divisions.

◆

The addition of two new district engineering representatives to the company's Alabama regional office has been made known by Huck Mfg. Co. **Bruce B. Wilson,** with offices in Birmingham, serves customers in Alabama, northwest Florida, and parts of Tennessee. **Charles M. Reyle,** located in Miami, serves Florida.

◆

Transferred to the sales staff of Clearing Machine Corp., division of U. S. Industries, Inc., is **George W. Petruck.** Formerly service manager for the company, he will serve the southern part of metropolitan Chicago.

◆

Thomas E. Clagett is the newly appointed Detroit district sales engineer for Wickes Machine Tool Division, Wickes Corp.

◆

Denzil Hawkins of Dayton and **Theodore Rancont** of Detroit have been named vice presidents of The Producto Corp., distributor of die sets, die accessories, and toolroom equipment. They are branch managers in their respective cities and will continue in those capacities.

◆

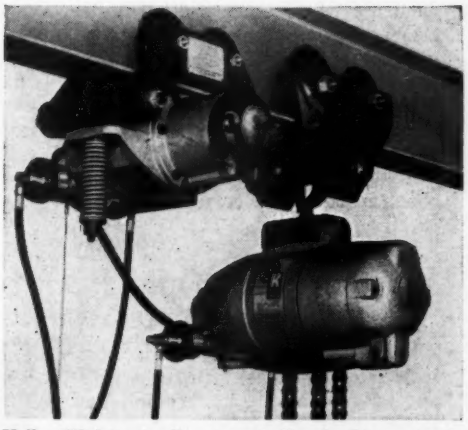
John S. Barnes Corp. announces several personnel changes. **Harry Cramer** has been named assistant sales manager for automotive and mass production industries. He will direct his activities to the sale of hydraulic structure pumps and valves. Assistant sales manager for machine tool hydraulics and related structures is **Carl Linde,** and **Ralph W. Palmer** takes over as technical sales manager.

◆

New general sales manager of Turchan Follower Machine Co. is **Wayne J. Neagles.** He will coordinate the activities of the sales, service, and engineering departments.

Put It Together Fast with a Keller Air Hoist

You can save time and muscle power in assembling machinery or fixtures by using a Keller 86-IVI0 air hoist. Weighing only 28 lb., but containing an extremely powerful axial-piston air motor, this compact little hoist handles loads up to 1000 lb.—lifts or lowers as quickly or as slowly as you wish. This variable speed—which can be reduced to a slow creep—enables you to position parts carefully, without marring or scratching finishes. Send now for bulletin describing these handy hoists.



Keller "Hoistractor," a power trolley for I-beam track, gives you power to move the load as well as hoist it.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

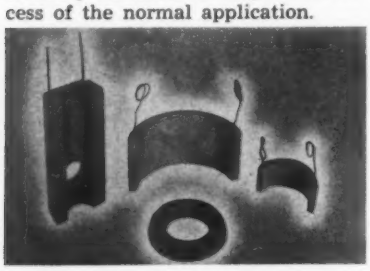
GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 99

MOLDED HEATING ELEMENTS HAVE VARIED APPLICATIONS

An extended development of a time proven industrial electric heating element has been announced for pipe, tube, and tank heating. It is essentially an arrangement of resistance coils embedded in a processed material which when molded and fired at high temperature, results in a strong ceramic block capable of withstanding temperatures of many hundreds of degrees in excess of the normal application.



These Thermoshell elements (Fig. 1) made by the Cooley Electric Manufacturing Corporation are furnished as hollow semi-cylinders of various thicknesses and lengths and in all diameters of standard pipe sizes. They can be obtained to fit elbows and pipe fittings as well as straight applications of the welded type. They can also be furnished in segments of large circles, the surface of spheres, or odd geometrical figures such as trapezoids or quadrilateral figures. Where they are to be mounted on surfaces that are not smooth, plane, or circular but have extensions such as pipe connections, elements with holes sufficient to clear these extensions can be furnished. In addition, elements can be furnished with thermocouple holes so that the thermocouples may be introduced through the element to the object which is being heated.

At present Thermoshells have been furnished to heat to a temperature of 2,000°F, but they are not limited to such excessive temperatures, as they can well be used at all lower temperatures from room temperature on up. The heat release of the elements is determined largely by the process to which they are being applied, but roughly they can be furnished in any wattage or BTU release from a nominal wattage to 30 watts/sq in (100 BTU's) of inside area of the element.

Based on experience with the use of these elements in high temperature furnace work, a life expectancy of many hundreds of hours can be met where the temperatures of the application are in the higher bracket of 2,000°F and slightly lower. At lower temperatures a practically indefinite life may be expected.

The installation of Thermoshells is relatively simple. Since the terminals of the elements are brought out radially, it is a simple matter to place them in half-circles of standard pipe insulation. These half-circles can then be enclosed around the pipe and banded to secure in place, following the usual practice of installing pipe insulation. At the extreme ends of the insulation, sheet metal caps are provided for protection (Fig. 2). The terminals of the elements are brought out to terminal boxes, and, where multiple installation of elements occur, these boxes can be readily connected by either thin walls or flexible tubing, and all connections brought to one location for line connection.

REMOVING HEAT TREAT SCALE FROM STEEL RAILROAD WHEELS

Effectively removing heat treat scale from cast steel railroad wheels and at the same time peening the surface to an attractive lustre are all accomplished at the rate of one wheel/min in the cabinet illustrated.

Each wheel casting is processed in the Wheelabrator special cabinet after a two-stage heat treatment and prior to final inspection. The speed and thoroughness of the process enables the special cabinet to clean the full production of the plant — 400 wheels/day.

OTHER P&W GA
APPLICATIONS A
CUMMINS:

SIMULTANEOUSLY CHECKING 8 CRITICAL DIMENSIONS . . . of cylinder liners, this Pi Sigmatic Multi-Dimensi Gaging Machine lets 1 man handle inspections formerly requiring 2 me . . . and production has b increased 2 to 3 times!

SE BLOCKS.

TEN-THOUSANDTHS PRECISION AT THE MACHINE . . . puts accuracy to work where it counts — right on the Cummins production line. Checking precis injector cups with this convenien located P&W Air-O-Limit Comparator, the machine operator can be *sure* at a glance that his work is within tolerance.

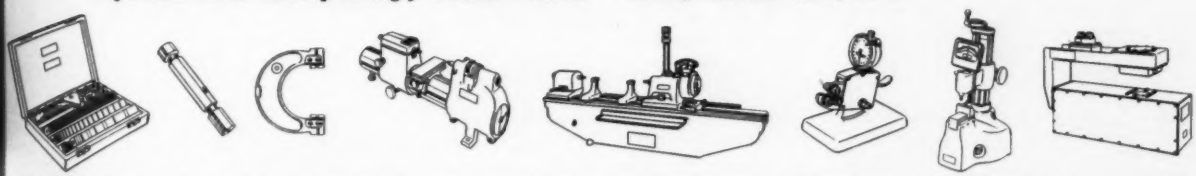
CIRCLE INFORM-A-GRAM

CUMMINS CUTS INSPECTION TIME 33%...

. . . and Pratt & Whitney Gages can bring *you* similar savings! One of the world's largest manufacturers of high-speed diesels the Cummins Engine Company believes that finer precision is a matter of increased production and greater profits. Gaging the depth of cylinder liner counterbores in cylinder blocks, Cummins was using a mechanical depth gage . . . checking at 2 points in each bore. To improve speed and precision on this vital inspection, Cummins switched to a P&W 3-Station Air-O-Limit Comparator. Inserted into the bore, the gage head checks depth at 3 points simultaneously . . . and a twist of the wrist provides readings around the entire circumference. Gaging time has been cut 33% with inspection costs correspondingly reduced. More accurate readings are obtained. And the full 360° inspection provides an extra assurance of product precision.

Because precision is important at Cummins, there are dozens of P&W Gages of every type in this plant. As their gage foreman states, "We like their accuracy and dependability – and the excellent service provided by the Pratt & Whitney Company."

You too can put greater precision to work to cut costs and increase production. Write now for more complete information on Pratt & Whitney Gages. Pratt & Whitney Company Inc., 15 Charter Oak Blvd., West Hartford, Conn.



GE BLOCKS. . CONVENTIONAL GAGES . . . SUPERMICROMETERS . . . STANDARD MEASURING MACHINES . . . COMPARATORS . . AUTOMATION AND CONTINUOUS GAGES

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

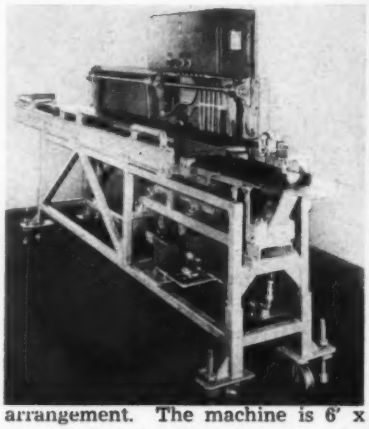
CIRCLE INFORM-A-GRAM KEY NO. 101

AUTOMATIC UNIT FEEDS HEAVY FLAT STRIP TO PRESSES

A standard automatic unit for feeding heavy flat strip stock to presses is announced by Press Automation Systems, Inc. This portable, plug-in automation unit is designed to handle strip stock of thicknesses beyond the capacity of conventional roll feeds and straighteners, and is adaptable to either single-operation or progressive dies.

Strip stock is rolled manually into a preload station and automatically lowered to a feeding station by air-cylinder controlled arms. The sheet of strip stock is fed into the press by a reciprocating mechanism having mechanical grippers. The stroke of the feed mechanism is adjustable to meet a variety of pressroom applications.

Electrical controls in the unit enable it to be tied into the press cycle to provide a fully automatic feeder



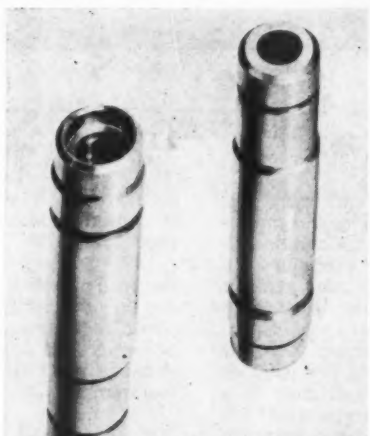
arrangement. The machine is 6' x 3' and length depends upon the lengths of strip stock to be handled Press Automation Systems, Inc. 25418 Ryan Rd., Centerline, Mich. or—**Circle Inform-A-Gram No. D1.**

BOR-DRILLING SMALL PARTS

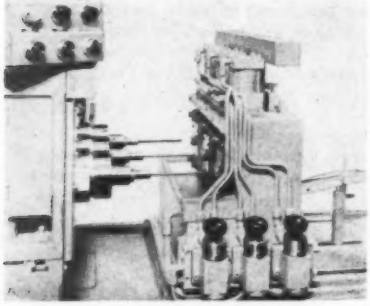
Equipping two Ex-Cell-O Style 112D precision boring machines for the Bor-Drill process, an automotive manufacturer is now producing workpieces with accurate, close tolerance holes from the solid.

The parts, transmission range selector shafts, are manually loaded and hydraulically clamped in a three-station fixture. Three Bor-Dril tools then advance simultaneously and bore a 0.312"-0.313" dia, 2½" long through hole in each of the three parts.

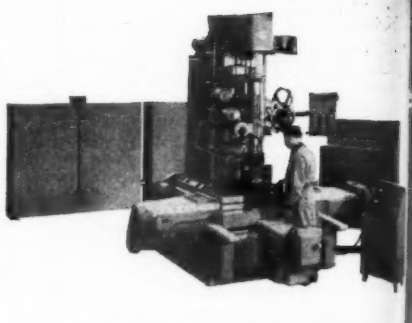
A safety feature incorporated in the fixture of each machine automatically precludes the breakage of tools due to unclamped parts in the fixture. Should the operator fail to depress the knobs that actuate part clamping at each station, a safety clamp on top of the fixture retracts the machine table so that the tools cannot enter the workpieces. The machine will not cycle until each part is securely clamped in its station.



These automotive transmission range selector shafts have been Bor-Drilled to 0.312"-0.313" dia for a distance of 2½".



Closeup of an Ex-Cell-O 112-D precision boring machine equipped for the Bor-Dril process shows the three Bor-Dril tools about to enter the three-station fixture. Clamping knobs are shown in the foreground.

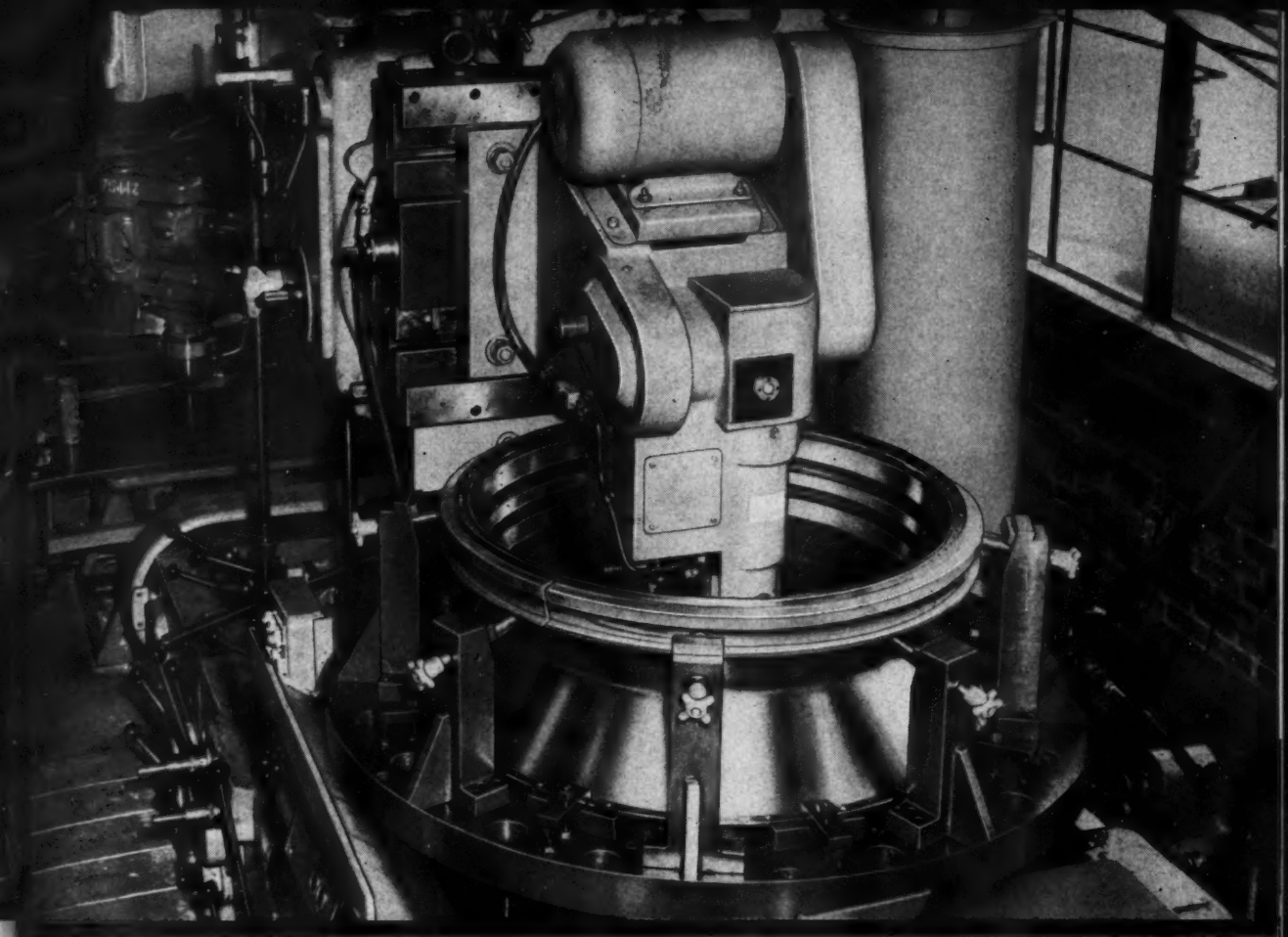


OTHER P&W NUMERICALLY CONTROLLED MACHINE TOOLS

. . . include the Electrolimit Jig Borer and the Vertical Precision Hole Grinder.

CIRCLE INFORM-A-GRAM KEY NO. 103

JIG BORERS



NO MISTAKES with NUMERICAL CONTROL

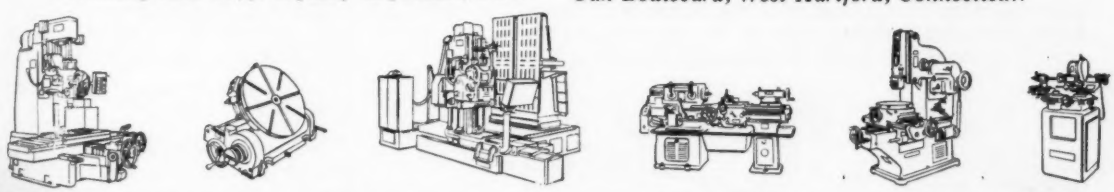
. . . and Machine Time Cut 46%!

These were the results when a Pratt & Whitney Numerically Controlled Rotary Table was put to work by Lycoming Division of AVCO Manufacturing Corporation. This job involves milling 236 slots accurately located on three rings within jet engine cases. Directed by a punched tape, the new table automatically indexes the work for each cut. Indexing is accurate to 5 seconds of arc. In addition, the table's numerical control system governs the milling feed motions . . . putting the entire operation on an automatic cycle.

Replacing a hand-indexing rotary table, the P&W Numerically Controlled Rotary Table has cut machining time 46%! Equally important, P&W Numerical Control eliminates operator error in locating the 236 slots . . . which would turn a nearly completed workpiece into scrap.

Lycoming's experience is no isolated example. Applied to P&W Rotary Tables, Jig Borers and other machines, Pratt & Whitney Numerical Control is producing equally spectacular time-and-money savings in many other plants. It may well offer opportunities for greater profits in *your* plant.

Write now for complete information. Pratt & Whitney Company, Incorporated, 15 Charter Oak Boulevard, West Hartford, Connecticut.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

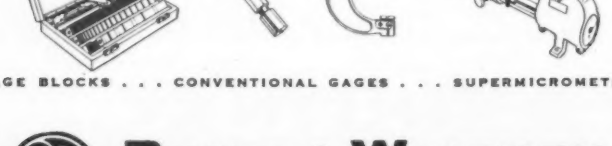
CIRCLE INFORM-A-GRAM KEY NO. 103

Because precision is always important,

only the finest is good enough!

Whether you're working to tolerances of several thousandths or holding dimensions within a single "tenth", effective quality control and profitable operation demand that *all* work be measured against dependably accurate standards. That's why, where precision is concerned, you can't afford less than the best, regardless of price.

Easiest way to be sure of the best is to select Pratt & Whitney Gages. From start to finish . . . from the use of only the finest gage steels to the final lapping process . . . Pratt & Whitney gives extra care and attention to every detail that can contribute to finer quality, greater precision and better wear resistance. As a result, P&W Gages *are* accurate . . . *stay* accurate longer. Write now for complete information. Pratt & Whitney Company, Inc., 15 Charter Oak Blvd., West Hartford, Conn.



GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 104

Presenting . . .
Representing . . .

Tri-State Machinery Co. of Pittsburgh serves the western Pennsylvania, West Virginia, northwestern Maryland, and eastern Ohio area for Greaves Machine Tool Co. Gulf Coast Industrial Supply Co. of St. Petersburg, Fla., serves western Florida; and W. D. Allen Mfg. Co. of Chicago, represents Greaves in northwestern and central Illinois.

•

Six distributors have been announced by the Abrasives Division, Elgin National Watch Co., to handle the division's line of solid carbide rotary tools. They are N. T. Bushnell Co., New Haven, Conn.; Durant Tool Supply Co., Providence, R. I.; Tools and Abrasives, Inc., Ft. Wayne, Ind.; and S.G.S. Tool Co., Akron, Ohio. Janco Industrial, Rockford, Ill., and B.S.A. Tools Ltd., Toronto, Ontario, are also representatives.

•

The Taft-Peirce Mfg. Co. has appointed The George D. Miller Co. of Cleveland to represent the line of machine tools in northern Ohio.

•

The Bud Watts Machinery Co. will serve Onsrud Machine Works, Inc., Machine Tool Division, in Tennessee and Arkansas. In upper New York state the company will be represented by The Fisgus Machine Co., and The J. M. Grisley Machine Tool Co. will serve in Utah.

•

The appointment of Hart Industrial Supply Co. of Tulsa and Oklahoma City as distributor in Oklahoma for hard carbide metal-cutting tools for Kennametal, Inc., has been made known.

•

The Landis Tool Co. has appointed the R. O. Deaderick Co., of Orlando, Fla., as distributor in the central Florida area.

•

Serving in Indiana and western Kentucky as representatives of United States Drill Head Co. is the C. C. Garrett Machinery Co. of Indianapolis.

•

The Motch & Merryweather Machinery Co. has been appointed exclusive distributor of the Danly Machine Specialties, Inc., line of mechanical presses and special hydraulic machinery. The distributorship area covers the Motch & Merryweather territories, with offices in Cleveland, Cincinnati, Detroit, Dayton, and Pittsburgh.

FILMS TO SEE

Four 16mm sound and color movies are described in a brochure released by the E. W. Bliss Co. Inclinable press maintenance, high production press maintenance, a 250-ton press in action, and transfer feed presses in the appliance industry are the pictures reviewed. The brochure is available from the E. W. Bliss Co., 1375 Raff Rd. S.W., Canton, Ohio.

◆

Useful information on various important automotive and industrial applications for ball, roller, and engine bearings and oil seals is presented in "Automotive Wheel Bearings." The Guide Film (sound slide films in color) consists of four separate film strips and records, and is available from Federal-Mogul Service, Division of Federal-Mogul-Bower Bearings, Inc., 11031 Shoemaker Ave., Detroit 13.

◆

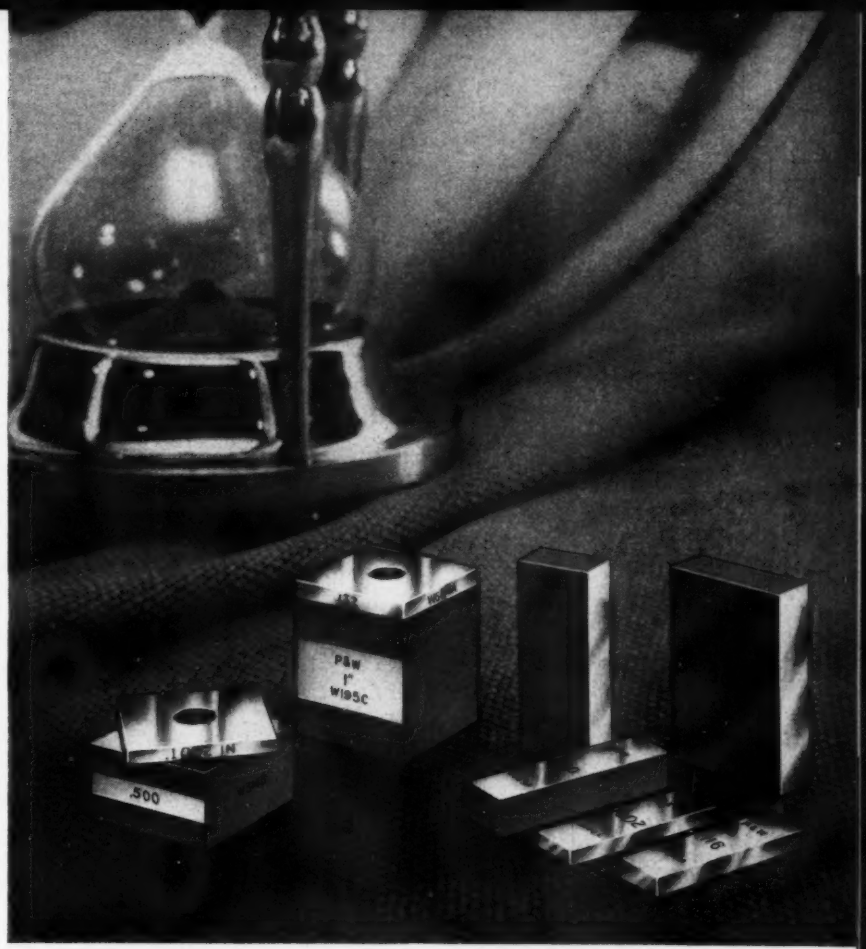
The Colorado Fuel and Iron Corp., P. O. Box 1920, Denver 2, has prepared a booklet describing 14 sound-color motion pictures which are available for free loan. The films describe various aspects of mining, steelmaking, and the manufacture of finished steel products. The 16mm films have running times of from 15 to 38 min.

◆

"You and Labor Law," a two-part 30-min sound slide film by Transfilm, describes the history, purpose, and principles behind our present labor law. Recognizing that no law is perfect and that interpretation of the law by the courts makes a big difference in how it works, the film is designed to stimulate discussion. It is for sale through the Employers Labor Relations Information Committee, Inc., 33 E. 48th St., New York 17.

◆

A motion picture dramatizing mill and fabricator practices in finishing stainless and carbon steel has been produced by Minnesota Mining and Manufacturing Co., Dept. F7-287, 900 Bush St., St. Paul 6. "A Challenge for Steel" shows several coated abrasive finishing methods including wide sheet grinding and polishing, strip scouring, and coil grinding.

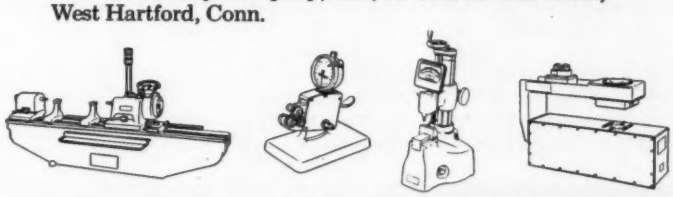


ARE ACCURATE!

STAY ACCURATE!

Accurate to millionths for size, flatness and parallelism, Pratt & Whitney HOKE® and USA Precision Gage Blocks meet *or exceed* every Bureau of Standards requirement. They stay accurate longer, because they're harder. First in the field, *only* P&W produces the HOKE® Block . . . the *original* square block with the hole through the center for easy assembly with tie rods.

Broad or extremely close tolerances, whatever your work requires, effective quality control and efficient production *always* demand comparison against an accurate fixed standard. That's why your choice should be Pratt & Whitney Precision Gage Blocks for permanent precision you can count on. Write for complete information. Pratt & Whitney Company, Inc., 15 Charter Oak Blvd., West Hartford, Conn.



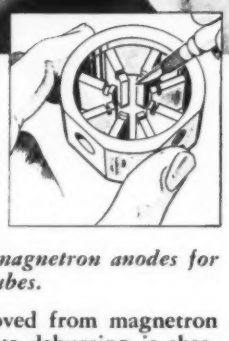
STANDARD MEASURING MACHINES . . COMPARATORS . . AUTOMATIC AND AUTOMATION GAGES

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 105



YOU TOO CAN REDUCE REJECTS!

Anton Machine Works, Brooklyn, manufacture magnetron anodes for radar, Geiger counter, X-ray and transmitter tubes.

PROBLEM: Minute burrs must be precisely removed from magnetron anodes . . . without altering contours. Accurate deburring is absolutely essential to eliminate deflections that change tube frequency.

SOLUTION: Operators use AO Spencer Stereoscopic Microscopes to effectively view and remove burrs with a small scalpel.

RESULT: Rejects practically eliminated. Productivity substantially increased.

You, too, may have a deburring problem . . . or other problems involving surface quality, measurements or assembly of small components. If so, why not investigate the most modern . . . versatile . . . and complete line of Stereoscopic Microscopes.

American Optical Company
INSTRUMENT DIVISION, BUFFALO 15, NEW YORK

DEPT. A179
GENTLEMEN:
Please rush new Stereoscopic Microscope brochure SB56.
NAME_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

At Your SERVICE

Screw machine products in various metals for all industries, and their facilities for precision machining of such products, has been announced by Star Stainless Screw Co. of Paterson, N. J. The company specializes in knurled and drilled parts, special threading, and cross drilled parts.

◆

Tollrolling of unusual metals and alloys such as zirconium, columbium, tantalum, and others in ultra-thin gauge and/or extremely high tolerance metal strip is handled by a division of American Silver Co. of Flushing, N. Y. A specially designed Sendzimir mill, rolling mills, continuous atmosphere annealers, and slitters are among facilities provided.

◆

Facilities of Induction Steel Castings Co., Inc., East Detroit, include induction melting furnaces, heat treating furnaces, grinding machines, and pressure molding machines suitable for production runs. General jobbing castings are jigs, fixtures and dies, machine tools, and material handling equipment and conveyors.

◆

Scientific computation and mathematical analysis service for business and industrial organizations is now being offered by The Ramo-Woodridge Corp. of Los Angeles. Consulting in computer applications and digital computing services including numerical analysis, programming, and equipment rental are offered.

◆

Automotive Fabricators, Inc., Detroit, will solve production problems from the blueprint to the finished part with zinc alloy dies. If last-minute design changes are necessary, production can still be started within six weeks.

◆

Pipe and tubing fabrication problems are handled as a low cost service by the Vogel Tool and Die Corp. This applies not only to cutting and notching, but also to piercing, flaring, slotting, bending, and many other operations for which equipment is available.

CIRCLE INFORM-A-GRAM KEY NO. 106

WHICH DIE STEEL WOULD YOU USE

to get "skin-fit" mating—250 million output?

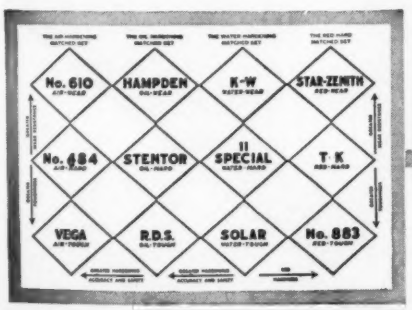
These dies for trimming .003" thick aluminum foil food containers presented the toolroom with this really tough set of tool and die requirements: Make the dies all in one piece . . . finish them to actual size before hardening . . . provide "skin-fit" mating after hardening with no finish grinding . . . and build the dies for multi-million production.

Suppose the decision on which die steel to use were up to you. Would you risk your reputation on any other steel than the one this toolroom decided to use?

Carpenter VEGA (Air-Tough) Die Steel came through with this remarkable performance: After hardening, the toolmaker discovered that the two die sections and two draw rings held to .0003"/.0004" *overall* . . . not just per inch. No finish grinding was necessary . . . a perfect "skin-fit" was assured. Machining the dies from a solid bar of die steel eliminated the need for welded or bolted sections.

The two VEGA rings are engineered to produce a staggering 26 million pieces before any grinding modifications . . . and a total production of 250,000,000 pieces. This Report is one of *hundreds* based upon actual plant records to prove conclusively the improved results obtained with Carpenter Matched Tool and Die Steels.

When will you join the growing number of plants who are enjoying better, lower-cost results? It will pay you to call Carpenter—get in touch with your nearest Carpenter Mill-Branch Warehouse, Office or Distributor today.



● U. S. Patent Office, The Carpenter Steel Co., Reading, Pa.

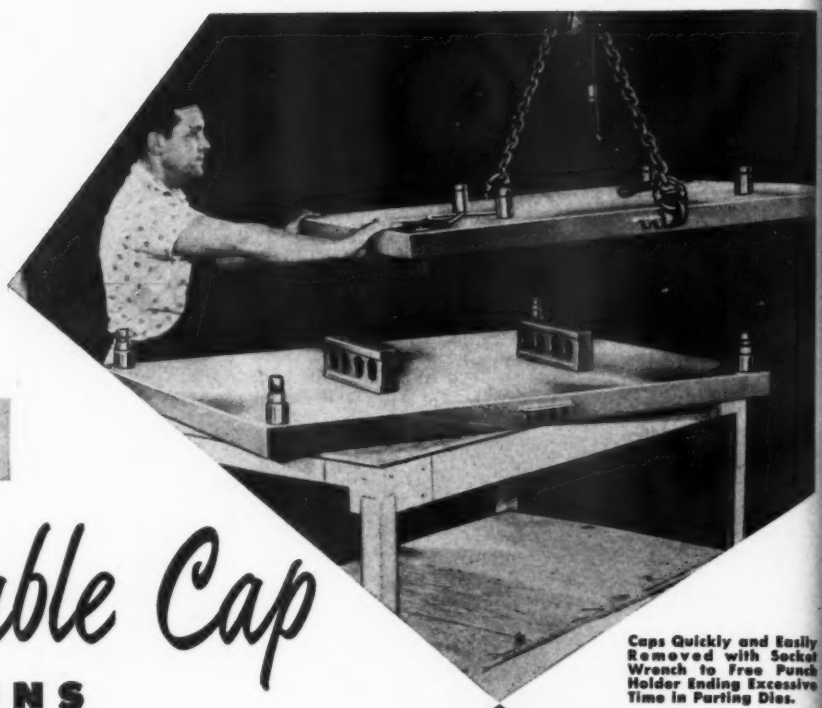
Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 106 W. Bern St., Reading, Pa.

Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

one man parts large die set in 3 minutes *with*



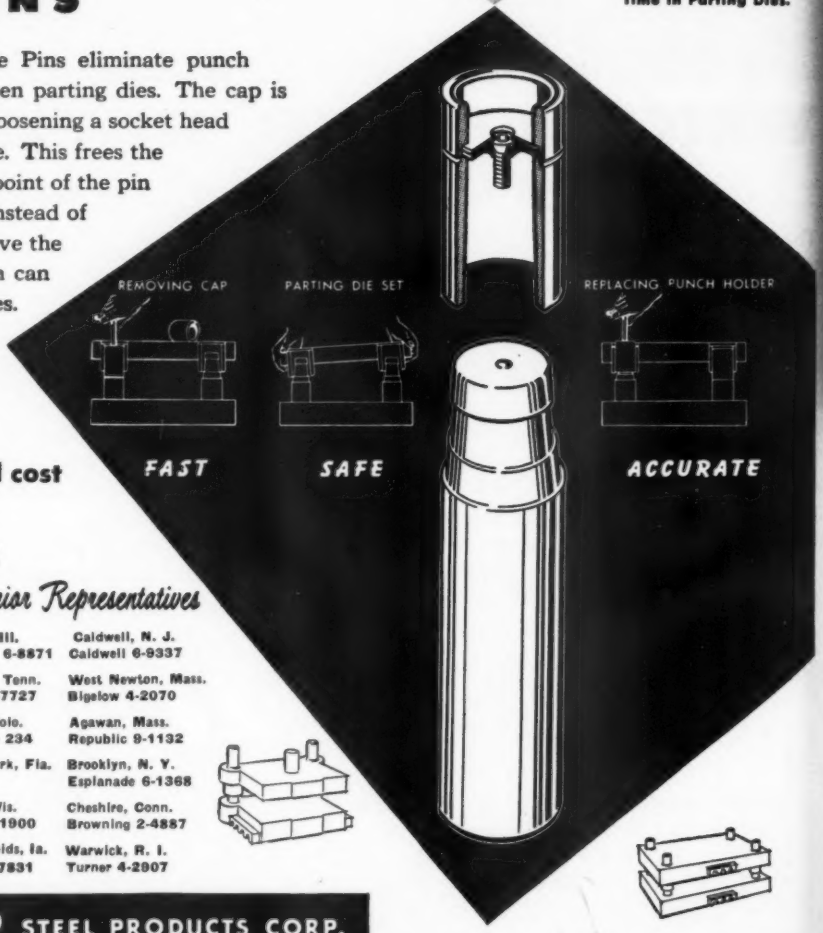
Caps Quickly and Easily Removed with Socket Wrench to Free Punch Holder Ending Excessive Time in Parting Dies.

SUPERIOR

Removable Cap

GUIDE PINS

Superior's Removable Cap Guide Pins eliminate punch holder binding on guide posts when parting dies. The cap is removed from the pin merely by loosening a socket head screw which holds the cap in place. This frees the punch holder at the most critical point of the pin where it is apt to cock or bind. Instead of needing 2 or 3 die makers to remove the punch holder from a set, one man can do this work alone in a few minutes.



NOW on every Superior die set in diameters from 1½" upward at no additional cost

For Fast Local Service Call these Expert Superior Representatives

2 PLANTS TO SERVE YOU

Milwaukee, Wis. Mitchell 5-6027

Plainville, Conn. Sherwood 7-2761

Kalamazoo, Mich. Fireside 5-7988	Chicago, Ill. Randolph 6-8871	Caldwell, N. J. Caldwell 6-9337
St. Louis, Mo. Jefferson 5-1223	Memphis, Tenn. Fairfax 3-7727	West Newton, Mass. Bigelow 4-2070
Indianapolis, Ind. Clifford 5-5668	Denver, Colo. Enterprise 234	Agawan, Mass. Republic 9-1132
Rockford, Illinois 3-3931	Winter Park, Fla. 4-0464	Brooklyn, N. Y. Esplanade 6-1368
Dayton, Ohio Hemlock 6209	Racine, Wis. Melrose 2-1900	Cheshire, Conn. Browning 2-4887
Minneapolis, Minn. Franklin 1-1321	Cedar Rapids, Ia. Empire 2-7831	Warwick, R. I. Turner 4-2907

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

"A new press just wasn't in the cards...

so we rebuilt this one and saved ourselves a lot of money!" And it can be done with any Bliss press. Bliss has developed 42 modernization "packages"—pre-engineered assemblies—all you need to make an old press act young again. Add faster clutches, modern adjustments, more compact gearing, greater capacity. Do it in *your* own plant to keep downtime at a minimum. Or have Bliss do a complete rebuilding job for you.

Which is better? It's up to you. We'll give you the facts, but it's up to you. For here at Bliss, we consider the sale but the beginning of our responsibility. Which is what we mean when we say, "Bliss is more than a name... it's a guarantee."

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

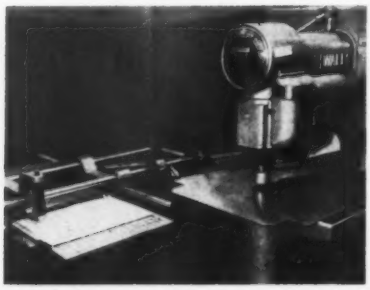
PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.

CIRCLE INFORM-A-GRAM KEY NO. 109

GRID LAYOUT CUTS HOLE PUNCHING TIME

A grid layout table and tracer control device has been developed by Martin to be used on the Wales semi-automatic hole punching fabricator for punching chassis holes. This equipment replaces hole drilling operations as the job was originally performed.

As designed, the fabricator worked from a template clamped on the press bed. The punch was manually set on the proper hole location, punched, and then moved to the next setting. This method was, of course, quicker than drilling but it was limited in that, to obtain optimum results, a series of congruently patterned chassis had to be punched. However, since two test tool chassis with like patterns are not often needed, the template was more of a disadvantage than an advantage. With each chassis, a new template had to be laid out, with a consequent loss of time and money.



The Martin designed grid layout table and tracer control device are shown set up with a Wales semi-automatic hole punching fabricator.

Martin, therefore, designed a grid layout table and a tracer control unit so that the punch can be worked directly from a blueprint rather than from a template. Dies, ranging in diameter from $\frac{3}{32}$" to $3\frac{1}{2}$", are used to punch holes for terminal and resistor boards and other components located in an electronics chassis. Using this adaption, an actual-size blueprint is taped on the 30" x 40" grid layout table. The blueprint and the chassis sheet are correspondingly positioned by the centering hole. The tracer is then set on the print in the desired hole location, the control lever depressed, and the hole is automatically punched in the sheet metal clamped to the control arm on the press bed. The tracer control is then moved to the next location and the process repeated.

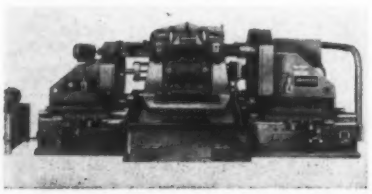
Since the blueprint is drawn to the exact size of the chassis sheet, the pantograph arm works on a one-to-one ratio, although the ratio can be varied if the work calls for it. However, it has been found more efficient and accurate to work from an actual-size blueprint.

A special die is used to notch the corners of the chassis sheet. Future punches will enable the fabricator to punch square, oblong and keyway holes and slots.

Notched blank, punched blank, and formed case show the sequence of punching holes directly from a blueprint.

PROCESSING CRANKSHAFTS ON A SIX-STATION MACHINE

Capable of producing 64 automotive crankshafts/hr at 100% efficiency, this six-station, two-way trunnion machine is designed so that four different crankshafts can be processed without the need of fixture detail and tool change.



The left-hand head drills, countersinks, counterbores, spotfaces, and taps one hole in the front end of the crankshaft. The right-hand head drills, countersinks, and reams eight bolt holes; drills, counterbores, and countersinks one hole in the rear end of crankshaft.

The eight bolt holes are held concentric with the OD of the rear end flange by piloting the bushing plate on the flange of the workpiece.

This machine was designed and built by Buhr Machine Tool Company.

Let me show*

**James C. Brown... P&J Representat... in the Ohio area.*

how changing t... a P&J Automa... helped DeVilbiss . .

JOB FACTS:

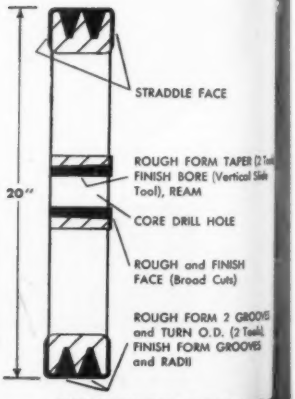
PART: *Air Compressor Flywheel*

MATERIAL: *Cast Iron*

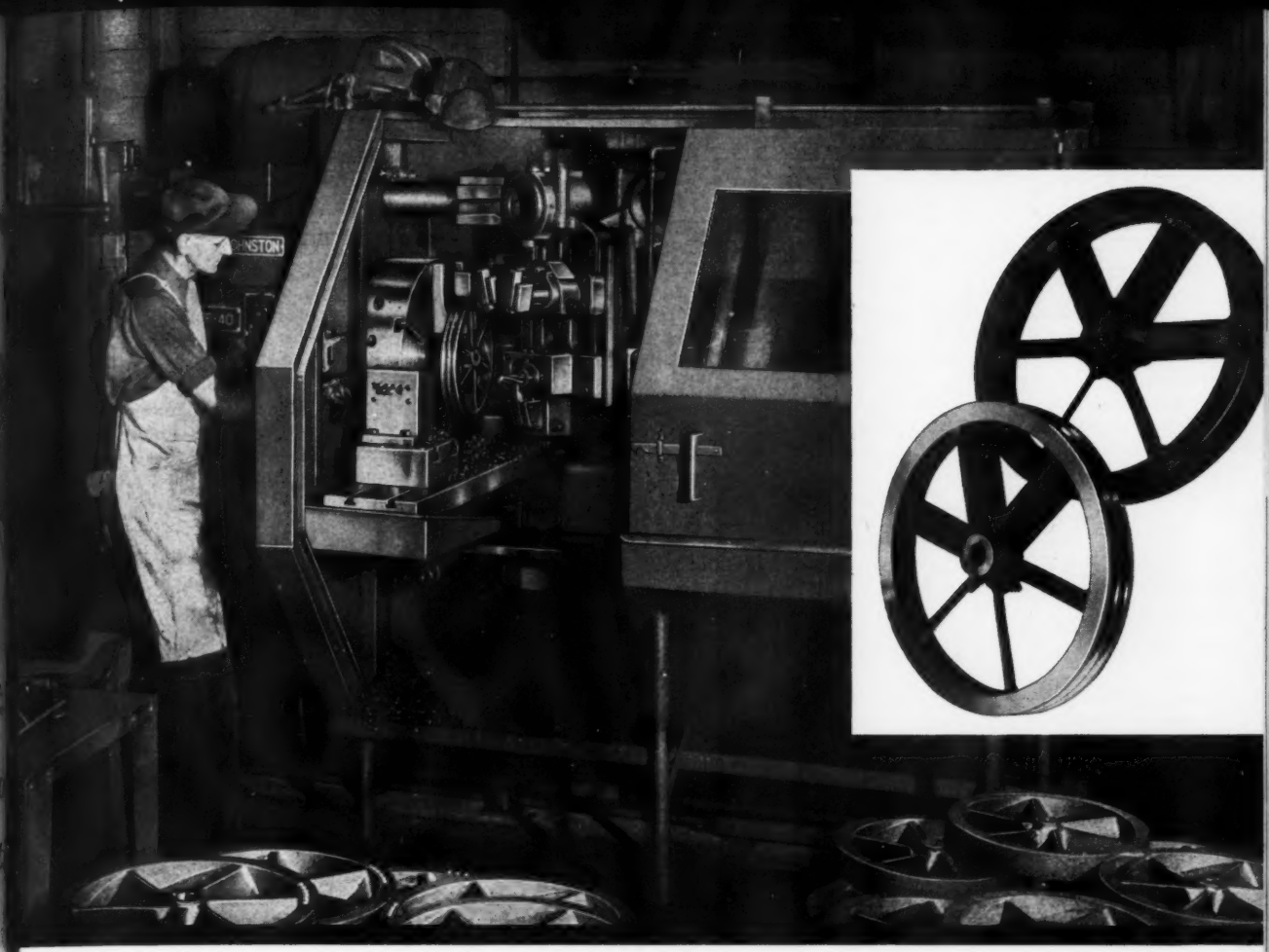
REQUIRED: *5 turning, boring, fac... grooving and reaming operations*

THE MACHINE: *A P&J 6DRE-40 A... matic Turret Lathe*

THE RESULTS: *22 pieces completed ... 4-hour shift . . . with the oper... also handling 2 other second... operations*


STRADDLE FACE
ROUGH FORM TAPER (2 To...
FINISH BORE (Vertical Slide Tool), REAM
20"
CORE DRILL HOLE
ROUGH and FINISH FACE (Broad Cuts)
ROUGH FORM 2 GROOVES and TURN O.D. (2 Tools)
FINISH FORM GROOVES and RADII

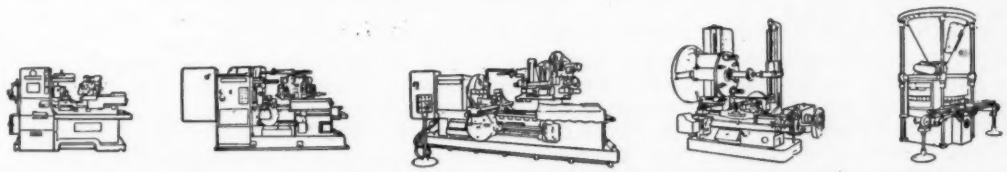
CIRCLE INFORM-A-GRAM KEY



. . SAVE 66% IN LABOR COSTS through "JOB INTEGRATION"

The Potter & Johnston 6DRE-40 Automatic Turret Lathe recently installed at the Toledo, Ohio plant of the DeVilbiss Company machines large, high-precision flywheels — handling 5 complex cuts on a fully automatic basis. Previously, using a hand-type lathe, this same job required 5 separate hand operations and the operator's full-time attention. Now, with the P&J *Automatic* on the job, the operator also handles two secondary operations . . . keyway broaching and balancing . . . that formerly required 2 additional operators working in separate departments. As a result of this new "job integration," labor costs have been reduced 66% with 2 men released for other work, overall time for flywheel production has been reduced 20 to 30%, and costly time-wasting intra-plant handling has been eliminated.

If your manufacturing operations demand high-speed, economical production of precision parts, a switch to P&J Automatics can help reduce machining time and costs . . . and may also make it possible to streamline a whole series of related operations. Act today. Let us send the P&J Representative in your area to analyze your requirements and recommend a production plan to meet your needs. Write direct to Potter & Johnston Company, Pawtucket, Rhode Island.



AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . PACKAGING MACHINES

POTTER & JOHNSTON

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898

CIRCLE INFORM-A-GRAM KEY NO. 111

Business Management Aids

A Square Root Calculator that is fully automatic is presented in a bulletin. The brochure also contains pictures of the machines, and advantages are listed. It not only performs all calculations normally performed on an automatic calculator, but also extracts the square root of a number with a touch of a single key. Copies of the brochure are supplied by Friden Calculating Machine Co., Inc., San Leandro, Calif., or —
Circle Inform-A-Gram No. F1.

"Be Your Own Storage Rack Expert" explains a concept of storage rack construction from ordinary pipe and the ease with which any type of rack can be assembled. The book points out how to construct the storage racks you need with the ordinary pipe and a simple universal clamp. In this way construct racks in half the usual time at half the cost. For your copy write to Tube-Strut Corp., 2960 Marsh St., Los Angeles 39, or —
Circle Inform-A-Gram No. F2.

Verti-File, an open shelf filing unit that saves almost 60% in floor space at a third the equipment cost, is outlined in a brochure. Features described in the brochure include: Verti-File's sections, either single-faced or double-faced, with adjustable shelves on one inch vertical centers; bottom shelves, elevated from the floor to protect folios from damage. Obtain your copy of the brochure on Verti-File from Deluxe Metal Furnitures Co., Warren, Pa., or
Circle Inform-A-Gram No. F3.

Adjustable Steel Shelving for industrial plants is presented in a bulletin. This 6-page bulletin describes and illustrates the company's six basic types of shelving, which are available. Photographs show construction features, the wide variety of different shelving arrangements possible with standard parts and accessories and a number of typical shelving installations at work. Copies of Bulletin SE-5 are supplied by Penco Metal Products Div'n, Alan Wood Steel Co., 200 Brower Ave., Oaks, Pa., or —
Circle Inform-A-Gram No. F4.

A Static Punched Card Reader designed for use with industrial processing and control systems is now manufactured by the Electronics Div'n, The Peerless Electric Co., Warren, O. The card reader accepts an IBM or any other standard punched card. Specification Bulletin TR-7 gives full description and schematic drawings. Write to the company for your copy, or —
Circle Inform-A-Gram No. F5.

"Production Control through Automation" explains some of the broader aspects of automation and indicates some of the procedures that have been found useful for its development and application within the continuous-flow industries. Brochures are obtainable from Patterson-Emerson-Comstock, Inc., Automation Div'n, 313 E. Carson St., Pittsburgh 19, or —
Circle Inform-A-Gram No. F6.

A Visible Control Tool, the VU Board, is the subject of a brochure which outlines the dimensions and advantages of the board. The brochure also illustrates the different uses of the VU board in addition to giving the specifications for these types. Write to Wassell Organization, Inc., Westport, Conn., for a copy of this brochure, or —
Circle Inform-A-Gram No. F7.

"Hi-Level Communications for Industry" is the title of a 6-page folder that describes and illustrates two-way loud speaking communication equipment for the mining industry. Equipment features include speakers, speaker assemblies, amplifiers, microphones, telephone handsets, etc. Write for Bulletin 1601-9, Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, or —
Circle Inform-A-Gram No. F8.

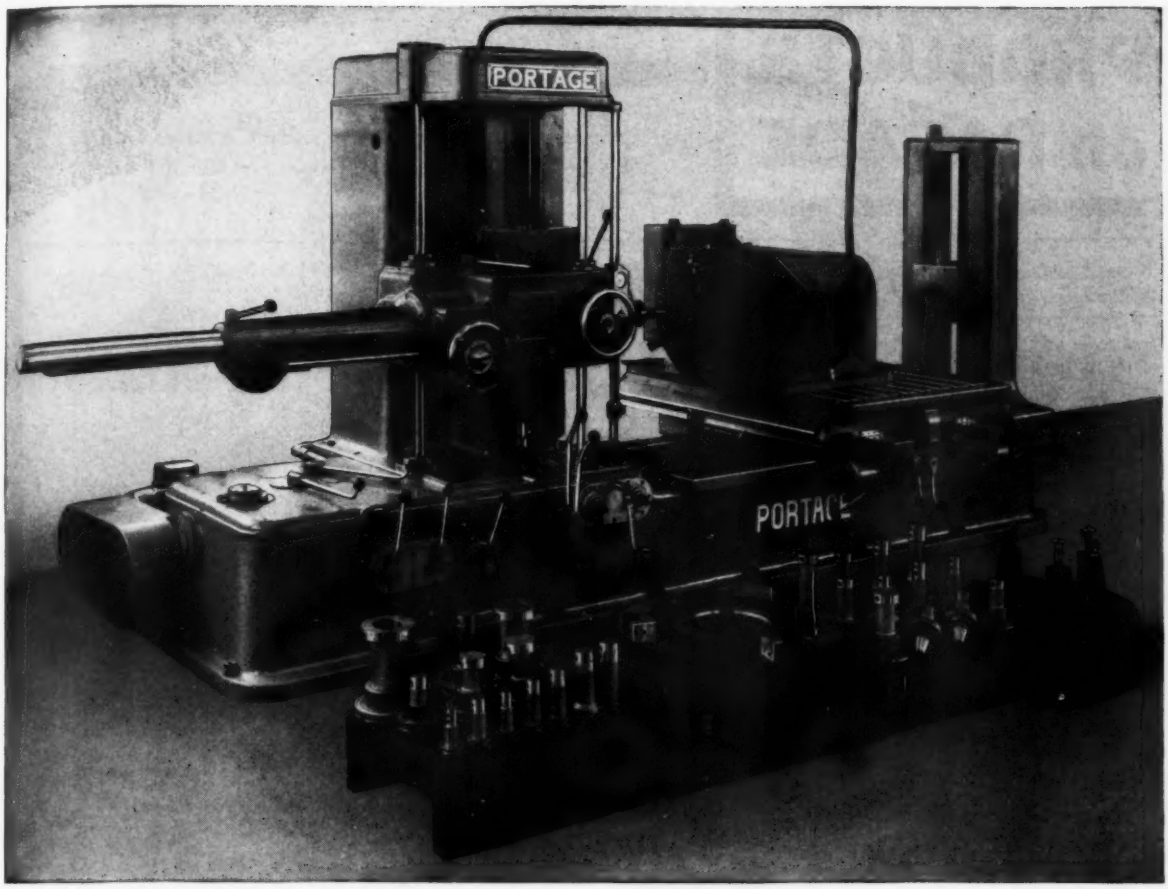
Save Time in analyzing and comparing equipment using the appraiser for new equipment additions. This appraiser will help those who buy, sell, or design equipment and give the benefits or drawbacks of the particular problem in a short time. Additional information about the appraiser can be obtained from Van D. Mark, P. O. Box 67, Mount Clemens, Mich., or —
Circle Inform-A-Gram No. F9.

XeroX Copying Equipment is the subject of a brochure which illustrates and explains fully the xerographic copying process and uses of each piece of XeroX equipment. A list of everyday uses and general duplicating requirements is included, suggesting improved means of cutting costs and speeding paperwork. Copies of Form X275 are available from The Haloid Co., Rochester 3, N. Y., or —
Circle Inform-A-Gram No. F10.

Engineering Reproduction Films, Cronaflex, are outlined in a booklet. Cronaflex projection film has high contrast emulsion on one side with an anti-halation coating on the other. Both sides are matted to accept pencil and ink. This and other advantages and characteristics are explained in the bulletin which has been offered by E. I. du Pont de Nemours & Co. (Inc.), Photo Products Dept., Wilmington 98, Del., or —
Circle Inform-A-Gram No. F11.

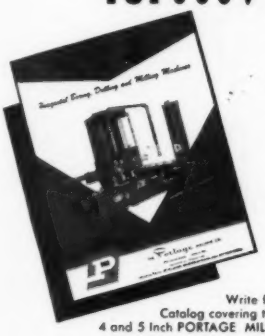
The Univac 120 punched card electronic computer is described in a booklet. The computer produces pay and cost figures faster and more accurately than previous methods and the booklet contains all information needed to program the computer to calculate the labor cost for each job, and to calculate each worker's total pay for the day. A copy of Bulletin U921 is published by Remington Rand Univac, 315 4th Ave., New York 10, or —
Circle Inform-A-Gram No. F12.

Automatic High Speed Film Mounter is made for mounting microfilms of engineering drawings, and other large volume documents. The mounter, which takes microfilm from reels and unitizes it by mounting individual frames to apertures in punched cards or ordinary file cards, operates at the rate of 2,000 cards/hr. It will process with either negative or positive microfilm reels, in lengths from 100 to 1,000 ft. For more information write to Filmsort Div'n, Dexter Folder Co., 50 S. Pearl St., Pearl River, N. Y., or —
Circle Inform-A-Gram No. F13.



Tooling is P.D.Q. Quick Change including Sure-Bore micrometer cartridges.

PORTAGE builds "special tooling" on new 4 inch Horizontal Boring, Drilling and Milling Machine for...Westinghouse Gearing Division



Write for Catalog covering the 4 and 5 Inch PORTAGE MILLS

This new 4 inch machine was built with a special vertical power indexing table. Unit can be set to index at any range with variables of 15 degrees between stations. Indexing accuracy can be held to less than 5 seconds of arc. Indexing and clamping are fully automatic with means for inching the table for setting-up purposes. This Westinghouse machine is just one example of the special purpose work being done for PORTAGE customers...

The Portage Machine Co. invites your inquiry for machines requiring special tooling... and remember... it costs less to buy, operate and maintain a PORTAGE.

THE Portage MACHINE CO.

1036 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

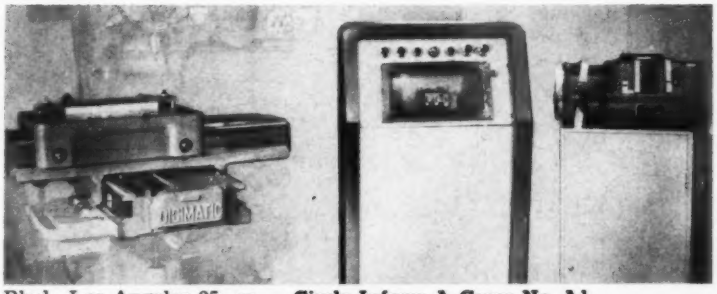
BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

CIRCLE INFORM-A-GRAM KEY NO. 113

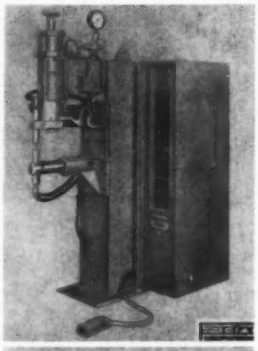
PRODUCTS on PARADE

For more information about the products described here, use POSTAGE-FREE Reader Service Card in this issue.

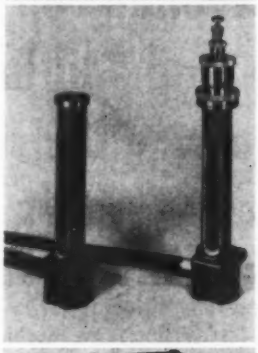
An Electronic Control System enables one drill press to do the work of five. A positioning table, control console, and tape punch compose the Digimatic Model 202 point positioner which is applicable for drilling, riveting, spot welding, etc. Drilling accuracy within 0.001", speed of positioning, ease of programming from shop drawings, and elimination of non-productive machine times are some of its features. Electronic Control Systems, Inc., 2136 Westwood Blvd., Los Angeles 25, or — **Circle Inform-A-Gram No. A1.**



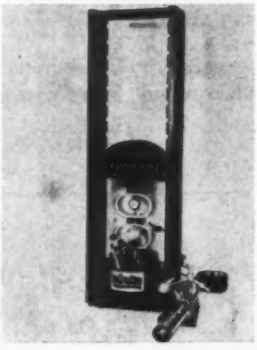
A Single Phase Spot Welder features a pneumatic double acting cylinder head, micro-finish cylinder walls, and molded, synthetic cup seals which reduce friction to a minimum. The SP 1 spot welder can be furnished with 18", 24", 30", 36", and 42" throat depths. Sciaky Bros., Inc., 4915 W. 67th St., Chicago, or — **Circle No. A2.**



Level or Align Jobs where optical or mechanical methods are not practical because of interference or distance, with the Watts micrometer water level. An interchangeable jewel needle point is used on the micrometer dipper for greater sensitivity. Engis Equipment Co., 431 S. Dearborn St., Chicago 5, or — **Circle No. A3.**

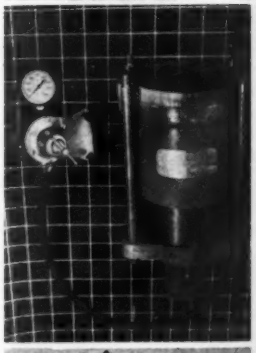


Quick, Accurate Compression Testing can be done with a portable, hydraulically operated machine. The versatile Model TP-121 has a capacity of 150,000 lbs. By removing 8 screws the position of the upper head can easily be changed. Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, or — **Circle No. A4.**

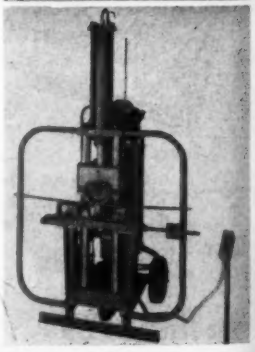


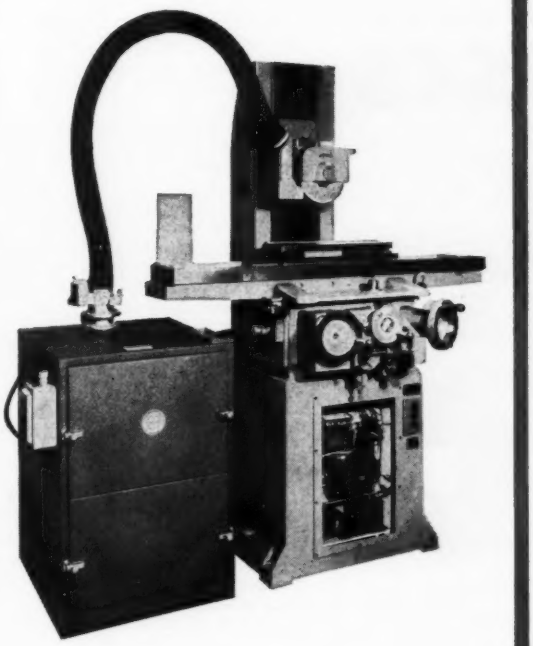
A Diamond Dresser is standard equipment on Sterling drill grinders. They incorporate a shifting lever to make it easier to change set-ups for different drill diameters through a range from ⅛" to 2½". A micrometer drill feed is available for all models. McDonough Mfg. Co., Eau Claire, Wis., or — **Circle No. A5.**

A Pneumatic Die Cushion can be applied to all power presses for all deep drawing requirements. It is adaptable to the pressure pad control on all forming dies, ejection requirements, etc. They come in sizes from 4" to 8" with ring holding pressures from ½-900 tons. Dayton Rogers Mfg. Co., 2824 13 Ave. S., Minneapolis 7. **Circle No. A6.**

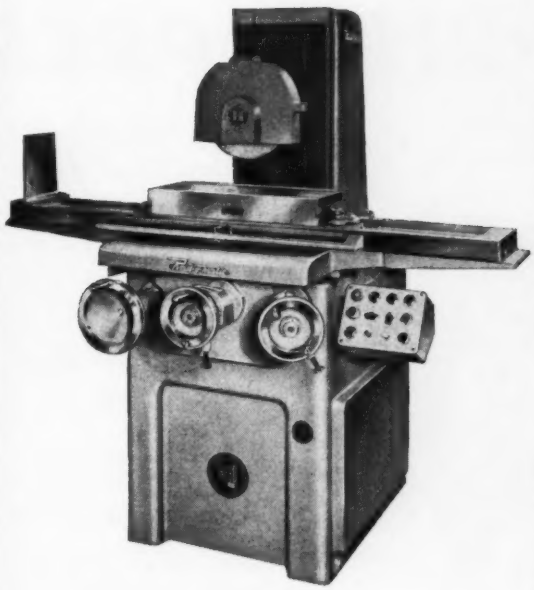


A Vertical Ram Type Bender bends up to 180° with no repositioning of dies or relocating of material, bending up to 2" heavyweight steel pipe. An initial setting of the duplicator stop will make an unlimited number of the same bends, if desired. Wallace Supplies Mfg. Co., 1304 Diversey Pky., Chicago 14, or — **Circle No. A7.**





MODEL 618 P
with dust collector



REID-O-MATIC 824 . . .
fully automatic

Industry's number one choice . . . for toolroom and production economy!

The vast number of REID *precision* surface grinders, in all kinds of industry, is the best proof of their outstanding quality.

In the 618 class these different models are available; a 618 P with power operated table and cross feed — a 618 PT with power table and hand operated cross feed — and a completely manual grinder, the 618 H. Automatic lubrication and a Cross Slide Lock are included on REID grinders as standard equipment.

The REID-O-MATIC is a fully automatic, all electric, surface grinder with a capacity 8″ wide, 24″ long and 21″ from the table to the center of the spindle.

For your production and toolroom grinding, REID surface grinders offer the maximum in convenience, quality and economy.

Accessories can be furnished for wet grinding, cool grinding, dust collecting and other needs.

Complete specifications will be sent on request.

PRECISION SURFACE REID GRINDERS

Manufacturers of precision surface grinders for production and toolroom needs

REID PRECISION SURFACE GRINDERS

REID BROTHERS COMPANY, INC. / 133A ELLIOTT ST. / BEVERLY, MASSACHUSETTS

CIRCLE INFORM-A-GRAM KEY NO. 115

KENCO 8-TON
PRECISION-BUILT
PUNCH PRESSES

MODEL 8

. . . rugged, fast and trouble-free

They're Kenco-built with long-wearing parts *throughout* to eliminate downtime and give you *many extra* years of steady, low-cost production. Rigid, multiple-rib frames and extremely long ram ways assure high precision production. Driving mechanism engineered for trouble-free operation. Press is competitively priced.

Model 8-R—8-ton deep-throat, Rigid-Rib

Same construction features, but with 12¾" throat, and tremendous resistance to breakage, deflection, or torsional twist.

Kenco presses—14 models—2 to 15 tons

Write for literature

KENCO MANUFACTURING CO.

5211 Telegraph Road, Los Angeles 22, California

CIRCLE INFORM-A-GRAM KEY NO. 1161

most **VERSATILE PIN GAGES** *made!*

Horberg exclusive taper feature lets you check undersize, oversize and odd-size holes, slots, etc., quickly and accurately with standard letter, number or drill-size gages.

A precision concentric taper on the lower half of each gage runs to 0.0012" smaller than gage size. You get a continuously accurate range of measurement with each gage, for quicker, handier, precision gaging in set-up, machining, tooling and inspection operations.

SPECIFICATIONS

Diameter accurate to +0.0001" −0.0000"
Standard 1.5" length
Concentric taper on lower half to .0012" smaller size
Oil hardened tool steel

PRICES AND ORDER FORM (F.O.B. Bridgeport, Conn.)

_____Letter sets—52 gages A-Z in pairs $65.00
_____Fraction sets—60 gages 3/64" to 1/2" in pairs $75.00
_____Number sets—120 gages 1-60 in pairs $130.00
_____Single gages_____size ea. $1.50

Sets furnished in indexed plastic case. Extra case $13.00
Prices subject to change without notice.

Please rush items checked to:

Name_____

Company_____

Address_____

Horberg GAGE COMPANY 29 Staples St., Bridgeport, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 1162

CONTRACT TOOLING AND PRODUCTION

Illinois

DRESEL-BETZ CO.
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings,

Michigan

DAVIS TOOL and ENGINEERING CO.
19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery. Sheet Metal Stampings and Assemblies.

Ohio

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave., Cleveland, Ohio. MU 1-2600
DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

GENERAL DIE & TOOL CO.
2067 W. 55th St., Cleveland, Ohio
WO 1-4736
Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

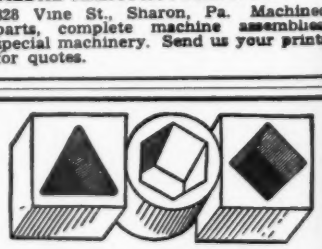
THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, Ohio. Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.
5601 Tillman Avenue, Cleveland, Ohio, WOodbine 1-2440 & 1-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio, Bedford 2-2800. Tooling, Short Run Production and Machined Parts for Automation.

Pennsylvania

MEDAL MANUFACTURING CO.
328 Vine St., Sharon, Pa. Machined parts, complete machine assemblies, special machinery. Send us your prints for quotes.

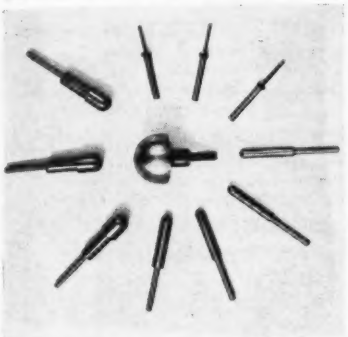


DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1163

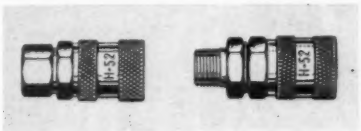
PRODUCTS on PARADE

Eliminate Errors and Rejects caused by bent stems and imperfect cutter-to-stylus ratios with tracer points. The tracer points are hard-



ened and ground and hold a concentricity to within 0.0005". The diameter of each tracer point is also held to within 0.0005". Aircraft Tool & Machine Co., 14800 Miles Ave., Cleveland 28, or —
Circle Inform-A-Gram No. A8.

A Coupler can be used for a variety of hook-ups because it is designed so that assembly can be made in the individual plant maintenance department. Type H-52 Quik-Koupler can be used for water or other

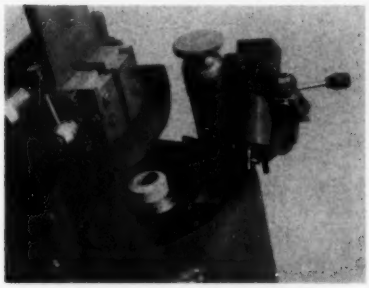


corrosive fluids because the plugs are furnished in cadmium plated steel or brass. Hofmann Engineering Co., 5601 S. Crawford Ave., Chicago 29, or —
Circle Inform-A-Gram No. A9.

A Versatile Feed Mechanism now makes it possible to automate a line of OBI's or other small press equipment. The Transflo feed is specially designed to transfer small piece parts

through a single press or through a line of up to six presses. Transfer fingers are easily replaceable to accommodate different piece parts. Clearing Machine Corp., 6499 W. 65th St., Chicago 38, or —
Circle Inform-A-Gram No. A10.

A Precision Drill Grinding Machine for applying the new Spiral Point to standard twist drills is offered by Cincinnati Lathe and Tool Co., Cincinnati 9. No center punching and reduction of workpiece distortion are two features of a Spiral Point drill. Spiropoint machine is built in two sizes, Model 500 to accommodate drills from ⅛" to ½" dia, and Model 750 for drills from ⅛" to ¾". **Circle No. A11.**



FINE CUTTING TOOLS by Eclipse

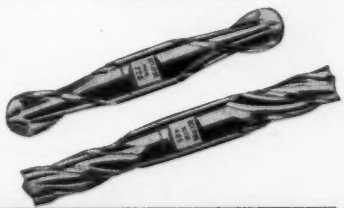
Since 1913 Eclipse has been consistently and conscientiously serving many companies in widely diversified fields of production. Each of these companies has found that "Engineered by Eclipse" is assurance of genuine quality in end cutting tools.

- High Speed Steel Cutters
- Carbide Tipped Cutters
- Core Drills
- Inserted Blade Cutters
- Multi-Diameters
- Back Spotfacers

and remember . . .

Eclipse now has a complete line of Precision End Mills. Ground from the solid, Eclipse End Mills insure longer tool life, finer finishes and lower production costs.

- Write for Counterbore Cat. No. 51
- Write for End Mill Cat. No. 56



ECLIPSE COUNTERBORE COMPANY
DETROIT 20, MICHIGAN
END MILL DIVISION—NORTH BRANCH, N. J. (ADDRESS BOX 97, RARITAN N. J.)

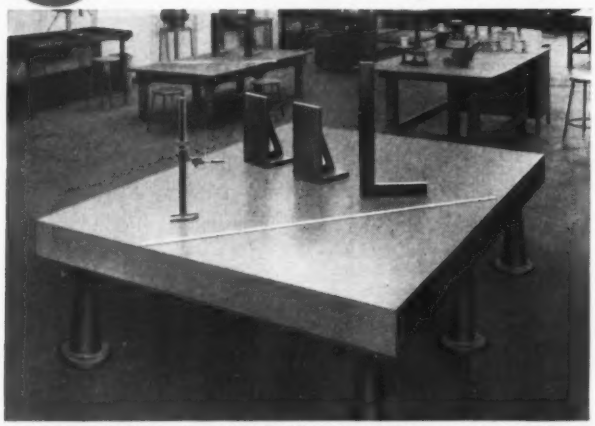
FOR CATALOG NO. 51 CIRCLE INFORM-A-GRAM KEY NO. 1171

FOR CATALOG NO. 56 CIRCLE INFORM-A-GRAM KEY NO. 1172

Renaud PLASTIC SURFACE PLATES

Fine Grain Granite

Faced with Ren Plastic



LOWER INITIAL COST
Savings up to 50% on the cost of this type of equipment over other types of surface plates.

FASTER DELIVERY
Eight (8) standard sizes can be delivered in less than half the time formerly required. Special sizes also available.

TRADE IN YOUR USED RENAUD PLATE
Should a Renaud plate need re-surfacing simply order a new plate and upon arrival return your used Renaud plate for generous trade-in allowance.

DIMENSIONS

Surface Dimension	Ledges No.	Ledges Ft.	Surface Dimension	Ledges No.	Ledges Ft.
24" x 60" (2' x 5')	0		48" x 72" (4' x 6')	0	
	2	10		2	12
	4	14		4	20
36" x 60" (3' x 5')	0		48" x 96" (4' x 8')	0	
	2	10		2	16
	4	16		4	24
36" x 72" (3' x 6')	0		60" x 60" (5' x 5')	0	
	2	12		2	10
	4	18		4	20
48" x 60" (4' x 5')	0		72" x 96" (6' x 8')	0	
	2	10		2	16
	4	18		4	28

Accurate within .002" T.I.R. of true plane across corners.
SHIPPING WEIGHT
100# per sq. ft. for 6" Thick — 170# per sq. ft. for 10" Thick
135# per sq. ft. for 8" Thick — 200# per sq. ft. for 12" Thick

ALL THE ADVANTAGES OF GRANITE PLUS

The stability of a hard Ren plastic surface which wears longer and is permanently level.

- Won't warp, swedge, rust or corrode.
- Non-magnetic — abrasive resistant.
- No oiling or special care needed.

WRITE FOR LITERATURE

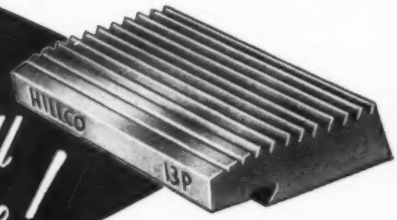
Renaud PLASTICS, INC.
5422 S. Cedar Road • Lansing 17, Michigan

PLASTICS FOR INDUSTRY SINCE 1938

CIRCLE INFORM-A-GRAM KEY NO. 1181

"HILLCO" TANGENT CHASERS

We think you'll agree!



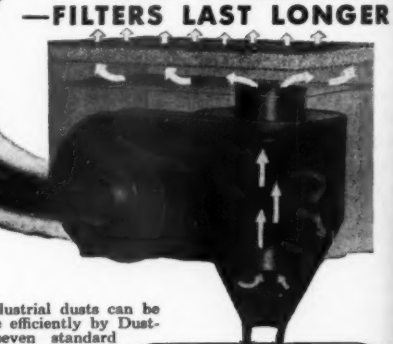
The new line of "HILLCO" Tangent Chasers, which can be re-ground for 80% of their original length, are guaranteed to be of highest grade tool steels ground to exacting tolerances. We feel that this complete line of chasers are the finest that we have produced in our 75 years of cutting tool manufacture. We think that you will agree with us.

THE HILL ACME COMPANY
ACME MACHINERY DIVISION
1203 West 65th Street • Cleveland 2, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1182

CYCLONE SEPARATION

FOR MORE EFFICIENT DUST COLLECTION —FILTERS LAST LONGER



Almost all industrial dusts can be collected more efficiently by Dustkop. Thirty-seven standard models *ready to use!* Reduce installation costs — save space. Write for descriptive literature.

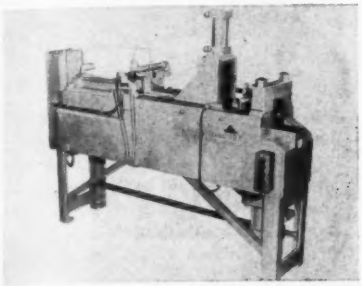
ALSO A COMPLETE LINE OF MIST COLLECTORS

DUSTKOP STOPS DUST

AGET MANUFACTURING COMPANY
1394 EAST CHURCH ST., ADRIAN, MICH.

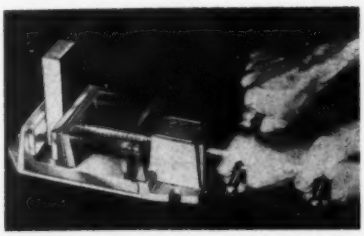
CIRCLE INFORM-A-GRAM KEY NO. 1183

A Double Stroke Tube End Forming Machine is hydraulically operated, and has a smooth, quiet motion that can be used for reducing or pointing the ends of tubing. The tube is clamped in a pair of split



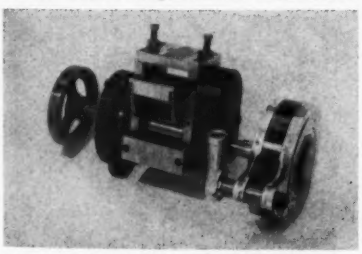
blocks and a tapered ring is pushed over the end of the tube. Model 7S can also be tooled up for expanding in diameter, flanging, flaring, double flaring, etc. The Vaill Engineering Co., 137 East Main St., Waterbury 20, Conn., or —
Circle Inform-A-Gram No. A12.

A Drill Press Vise combines rapid action with unlimited takeup and features a nut that engages and disengages the screw automatically.



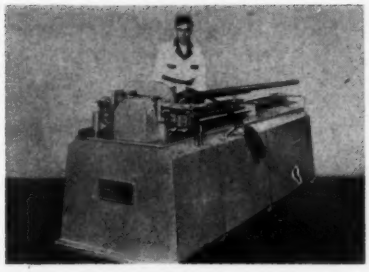
There are no buttons, no springs, and no triggers. Jaw depth is 1¾". Wilton Tool Mfg. Co., Inc., Schiller Park, Ill., or —
Circle Inform-A-Gram No. A13.

Easier Starting of Material Through Rolls is facilitated with a large handwheel on a roll feed. A ratchet brake, which makes possible easier brake adjustment and more



accurate feeding, is standard on all models. Rolls are supplied either hardened, ground, or knurled as required by customers, at no extra cost. Durant Tool Supply Co., 1-15 Thurbers Ave., Providence 5, or —
Circle Inform-A-Gram No. A14.

An Automatic Cut-Off Machine for non-ferrous tubing was designed to produce accurate, burr-free lengths of tubing at extremely high production rates. Additional attachments for the machine provide a fully automated cut-off unit that will straighten, temper, and round-form tubing from coiled stock. It is able to handle 2" dia, 7" lengths of copper tubing at 2,000 pcs/hr. Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19, or—**Circle Inform-A-Gram No. A15.**



And here's what it means to you!

Recent tests in drilling 16,300 holes show that there is a difference in bushings. In these tests Ex-Cell-O Bushings lasted twice as long as competitive makes.

These differences make Ex-Cell-O a leader: (1) High chrome, high carbon oil-hardening bearing steel, (2) uniform heat treating to 62-64 Rockwell "C". (3) Precision grinding of inside and outside diameters and under the head for perfect seating. (4) Ex-Cell-O's own standards for precision, tougher than A.S.A. standards.

Large inventories in Detroit, New York, Downey, Cal., Lima, Ohio, and London, Canada, keep your inventory down. You get immediate shipment. Write for an Ex-Cell-O Drill Jig Bushing Catalog today.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
EX-CELL-O FOR PRECISION
XLO
57-94

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

CIRCLE INFORM-A-GRAM KEY NO. 119

A C-Clamp Swivel. Perma-Pad, saves time and money. Conventional swivel pads will come loose or break when they are forced beyond their normal circumference of travel but with the Perma-Pad this is eliminated. It is made with stock that is three times as heavy as a conventional pad in the vital collar area, and no crimping is needed in assembly. They have a free swing through a 60° arc. Wilton Tool Mfg. Co., Inc., Schiller Park, Ill., or —
Circle Inform-A-Gram No. A16.

Finger-Tip Control and power downfeed bring ease of operation to a shear which has a capacity of ¼" mild steel. Conveniently located pushbuttons simplify cutter and downfeed operation on Model 33RC. Difficult hand feeding of cutters into

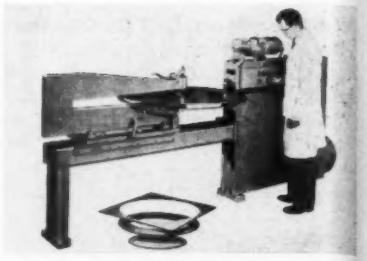
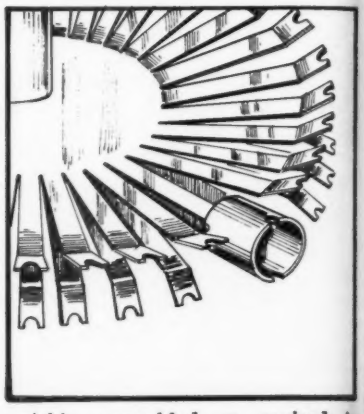


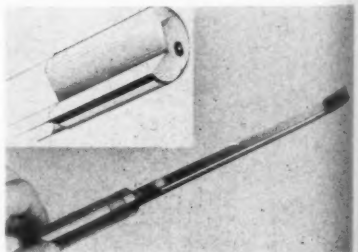
plate is eliminated. The lower cutter can be positioned laterally for best results with different thicknesses and types of materials. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, or —
Circle Inform-A-Gram No. A17.

Anodizing Racks of aluminum or titanium can be compared on any anodizer's production line with a rack comparison kit. Both titanium and aluminum workholders can be



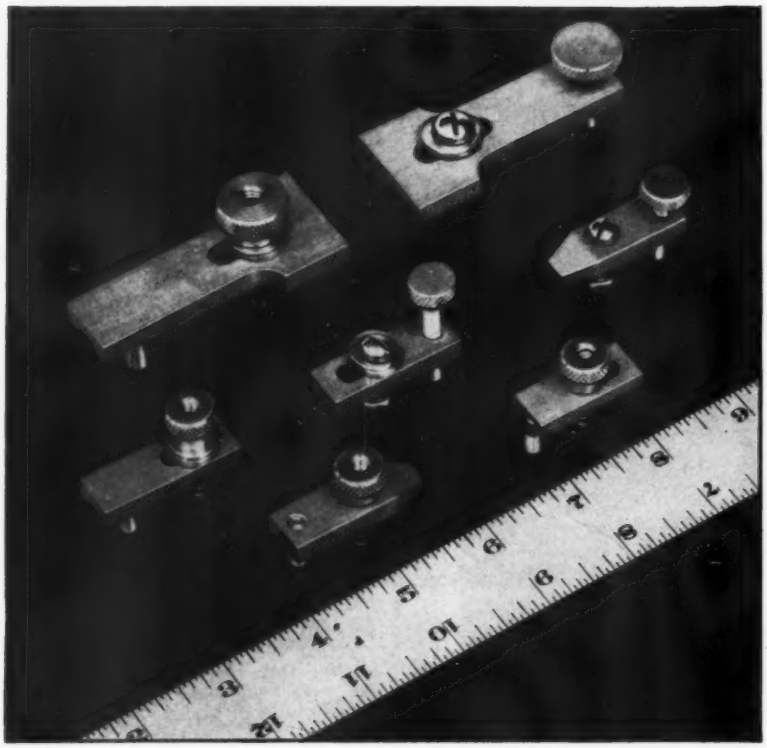
quickly assembled or revised to anodize a variety of parts. One of the three types of racks are shown. Service Screw Products Co., 131-C N. Green St., Chicago 7, or —
Circle Inform-A-Gram No. A18.

Drill Precision Holes from the solid in a single operation with a line of single-flute carbide gun drills. These drills can be used for producing



close-tolerances, long or short holes in ferrous and non-ferrous parts. Star Cutter Co., 34500 Grand River Ave., Farmington, Mich., or —
Circle Inform-A-Gram No. A19.

LODDING'S LITTLE FELLOWS



The Lodding line of stainless steel fixture components and clamp assemblies is complete and ready for you at your nearest Lodding warehouse. Carefully designed and made for essential holding in miniature operations . . .

- **Chisel Point Assembly . . .**
- **Wide Clamp Assembly . . .**
- **Knob Assembly . . .**
- **Thumb Screw Assembly . . .**

LODDING, INC.
WORCESTER 1, MASS.

Goodwin-Snader Co.
6814 S. Western Ave.
Los Angeles 47, Calif.

FACTORY WAREHOUSES

Bagby Engineering Co.
1047 Forest Ave.
Evanston, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 120

LONGER TOOL LIFE

FASTER CUTTING

LET YOUR CHIP TELL THE STORY

TAP CUT-25*

Modern Heat-Limiting

CUTTING FLUID

TAPPING | SHAPING | MILLING | PLANING

Your tool stays cooler... cuts longer... because Tap Cut-25 works two ways in the rupture area.

1. extreme lubricity aids in chip formation.
2. chemically active... it reduces rupture energy necessary for cooler cutting.

***TRY IT AT OUR EXPENSE!**

request 4 oz. working sample

UNITED LABORATORIES INCORPORATED

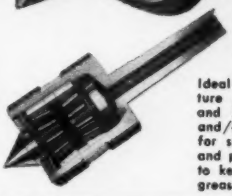
P. O. Box 918, Huntington, Indiana

CIRCLE INFORM-A-GRAM KEY NO. 1211

IDEAL GOLD BAND LIVE CENTERS

GUARANTEED TO MATCH OR EXCEED, "CRITICAL" JOB SPECIFICATIONS

In the GOLD BAND line Ideal has combined the latest production methods with their traditionally fine craftsmanship to bring you an unequalled standard of excellence in live centers. Accurate, (to ± .0001") GOLD BAND Live Centers offer "custom" quality at production prices. Specify GOLD BAND Live Centers and your every need can be accommodated from stock . . . 99 times out of 100. Ideal's GOLD BAND Live Centers offer savings, simplified operations and higher lathe output both in quantity and quality. Contact your distributor today...or



PRECISION FITTED BEARINGS

Ideal Live Centers feature precision machined and hardened ball and/or roller bearings for superior accuracy and performance. Sealed to keep dirt out, grease in.

A COMPLETE LINE FOR EVERY NEED...SPECIALS, TOO!

Send for

Complete catalog data and specifications.

IDEAL INDUSTRIES, Inc.

1334-A Park Ave., Sycamore, Ill.

DISTRIBUTED BY THE NATION'S LEADING INDUSTRIAL DISTRIBUTORS

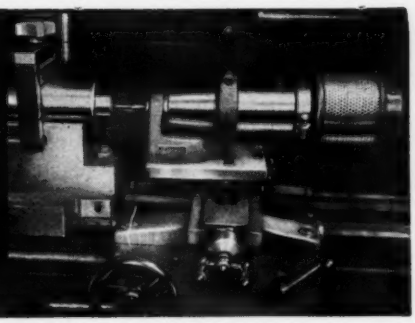
CIRCLE INFORM-A-GRAM KEY NO. 1212

production time

Reduced 48½%

at Atlas Press Co.

Kalamazoo, Michigan



with a Precise SUPER 60

Case History M-102

PROBLEM: Internal milling of drill press taper quill 1⅛". Tolerance: TIR on master arbor, .0002" one inch out and .001 four inches out on arbor.

FORMER METHOD: Grinding with tool post grinder. Production — 10 pieces in 5½ hours.

PRECISE SOLUTION: Super 60 Power Quill, with filtration unit, using PMW 1032 Micro Mill. Production — 10 pieces in 2¾ hours.

3741 Blue River Road
Racine, Wisconsin

HIGHLIGHTS OF SUPER 60 POWER QUILL

SUPER SPEEDS to 45,000 RPM — delivers full ½ H.P. at a load speed of 24,000 RPM.

EXTRA POWERFUL MOTOR allows heavier feeds and faster material removal — ideal for production set-ups.

ALL-STEEL HOUSING, precision ground and honed, only 2½" D. and 9½" overall length.

PRECISION COLLET CHUCK, ground and honed — up to ¼" size.

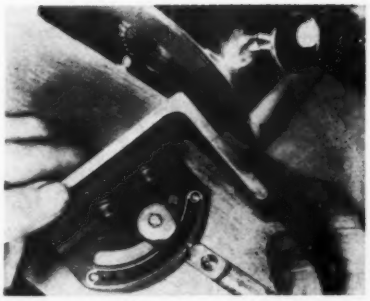
Available with COMPLETE LINE of MOUNTS, FILTRATION UNITS, and ELECTRIC SPEED CONTROLS.

Used SINGLY or perfectly adapted to MULTIPLE SET-UPS.

For complete specifications of the SUPER 60 POWER QUILL, and other PRECISE Power Tools from ⅓ to 1½ H.P., send for Free Catalog.

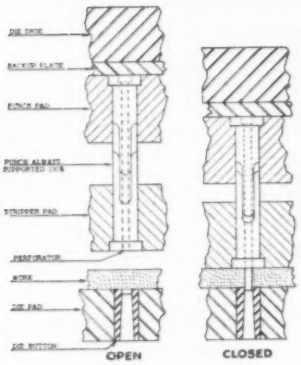
CIRCLE INFORM-A-GRAM KEY NO. 1213

An Angle-Set Metre Gage for use on tilt tables of carbide tool grinders has the ability to position tools at extremely small angles or extremely great angles while sharpening. The tool is resetable in four assembled combinations to give a complete 180° selection of tool rest positions as indicated on the calibrated 90° sector dial. Diamond Tool Co., Box 32, S. Haven, Mich., or —
Circle Inform-A-Gram No. A20.



Because . . .

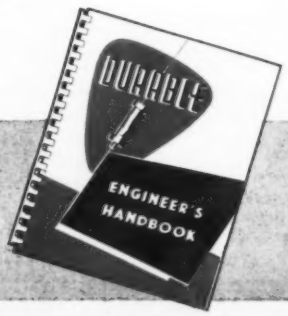
WHEN PUNCHING IT IS 100% SUPPORTED BY A TELESCOPING SUPPORT-SLEEVE



Typical Installation

A Durable Perforator stays "alive" longer, because it is supported 100% the full stroke of its Telescoping Sleeve.

You get positive alignment, closer tolerances, burr free holes, regardless of the types of metal used. Holes are punched faster, easier and accurately.



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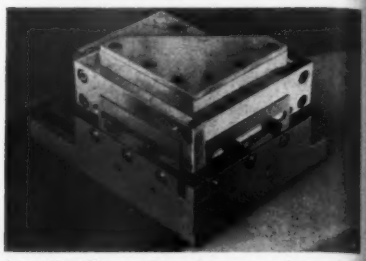
DURABLE ENGINEER'S HANDBOOK
121 pages showing
100 Practical Die Designs.
NO CHARGE, NO OBLIGATION

Patented and made exclusively by
DURABLE PUNCH & DIE COMPANY
9030 South Hermitage St., Chicago 20, Illinois

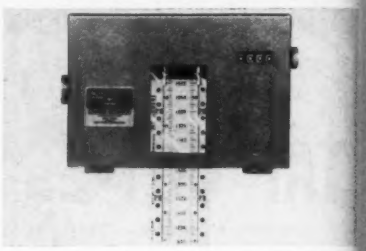
CIRCLE INFORM-A-GRAM KEY NO. 122

A Corner Notching Unit with removable, reversible punch and die blades are made in 3" x 3" and 5" x 5" sizes, right or left hand. Capacities are to ⅛" mild steel. The unit



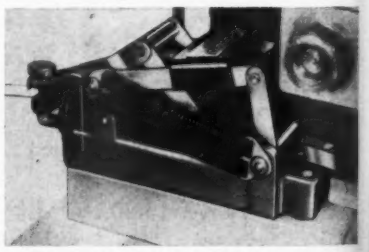
has ¾" dimensions from cutting edge to outside face of unit, and it permits close positioning to other units in a setup. Wales-Strippit Co., Akron, N. Y., or —
Circle Inform-A-Gram No. A21.

A Predetermined Print-Out Counter monitors production and machine operation. Tally-Print is adaptable for monitoring any production machinery, conveyor belt flow, and the data provided helps locate produc-



tion bottlenecks, and analyze tools, methods, and personnel. Tally-Print is available in 5-digit or 4-digit printers and four models. Standard Instrument Corp., 687 Broadway, New York 12, or —
Circle Inform-A-Gram No. A22.

A Quick Release Lock for the non-return blade provides rapid release, adjustment, and locking of the blade on a line of 2", 3", and 4" model automatic press feeds. The feeds



will handle coil stock in a range of widths up to 4", thicknesses up to 3/32", and with a range of feed stroke lengths up to a maximum of 4". Jaco Devices, Inc., 96 High St., Hingham, Mass., or —
Circle Inform-A-Gram No. A23.

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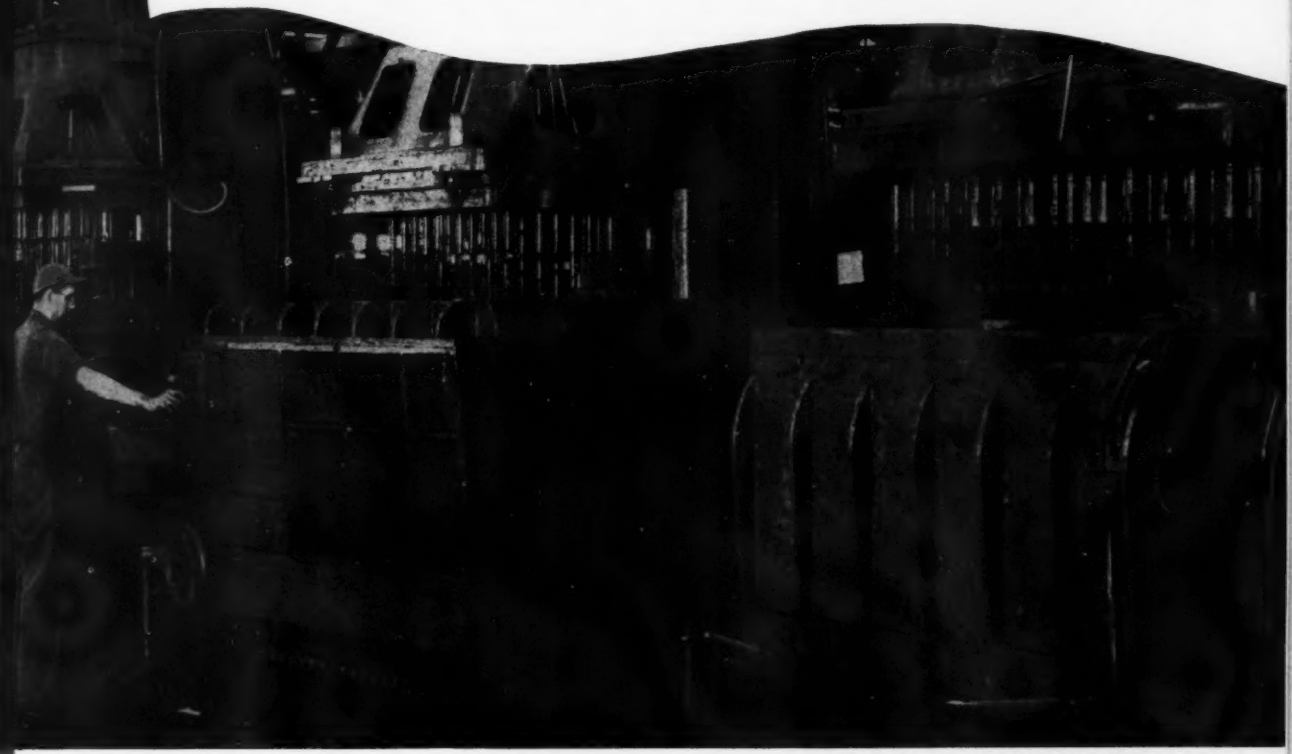

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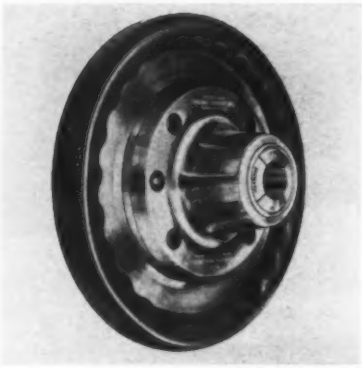
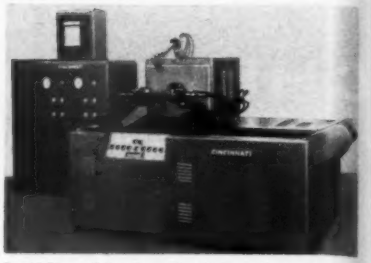


Increased Capacity from 25 to 40% and greater precision production are obtainable by using Hardinge-Sjogren speed collet chucks. Designed for use on all types of toolroom lathes, engine lathes, and grinders, this chuck is available in all sizes and adaptable to all machine shop requirements. Hardinge Brothers, Inc., Elmira, N. Y., or — **Circle Inform-A-Gram No. A24.**

Flexibility for a variety of flame heating applications is provided with the flame heating machine with

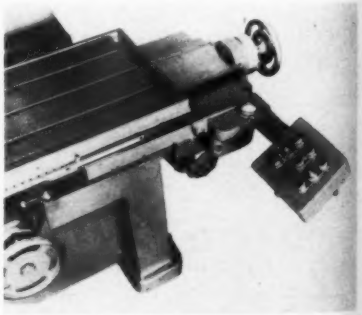


building block principle of construction. These redesigned machines are designed primarily for heat processing applications requiring high or low heating capacity, selective application of heat, precise temperature control, and automatic operation. Cincinnati Milling and Grinding Machines, Inc., Cincinnati 9, or — **Circle Inform-A-Gram No. A25.**

Find Internal Sounds in bearings, motors, gear-trains, turbines with the Detecto-Scope. This is an aluminum transistor unit powered by a battery. Its great sensitivity, range

of amplification, and convenient size make is a versatile tool for the trouble shooter. It will also check flow of liquids through pumps or pipes. Valley Engineering Corp., 15th and Elm Sts., Easton, Pa., or — **Circle Inform-A-Gram No. A26.**

A Layout Drilling Machine equipped with hob rods has a greatly extended range and increased ease in locating, drilling, and boring. Machines for job use are equipped with



micrometer dials and scales, and three methods of table and carriage movement are available. Cleereman Machine Tool Corp., 555 W. Washington Blvd., Chicago 6, or — **Circle Inform-A-Gram No. A27.**

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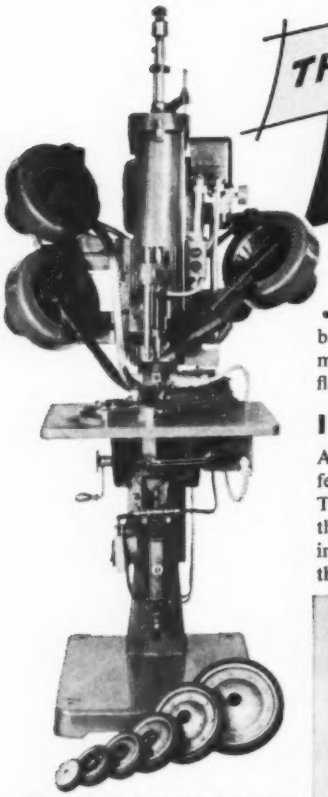
BOOSTS ASSEMBLY PRODUCTION 300%



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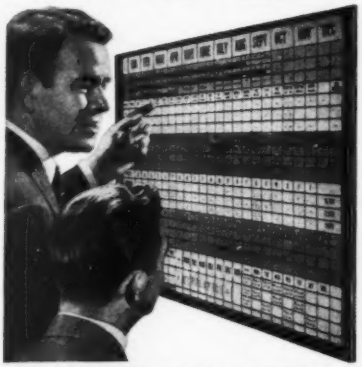

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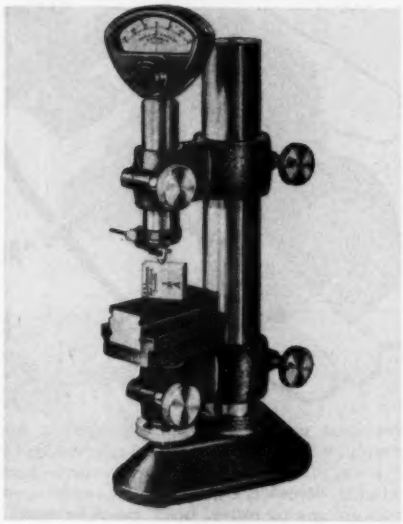

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FOR MEASUREMENT IN INCHES

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510-E4	0".0024	0".00005
510-E5	0".0014	0".00002
510-E6	0".0008	0".00001
510-E7	0".0004	0".000005
510-E8	0".0002	0".000002
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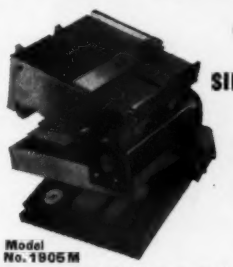

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VULCAN tools

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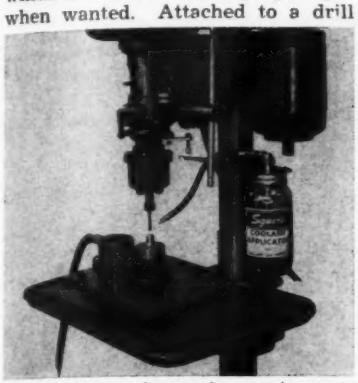
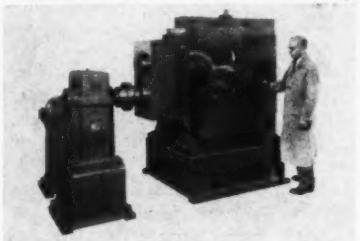


press column, the applicator is operated by a lever, which depresses the pump plunger. An actuating rod attached to the quill of the machine, makes operation automatic. Mechanical Appliance Co., Dept. TP, 1115 N. Franklin St., Chicago 10, or — **Circle Inform-A-Gram No. A28.**

A Turks Head forms special shapes from wire and rods. Model 121 may be compared to an adjustable draw die but, differs in that it is infinitely

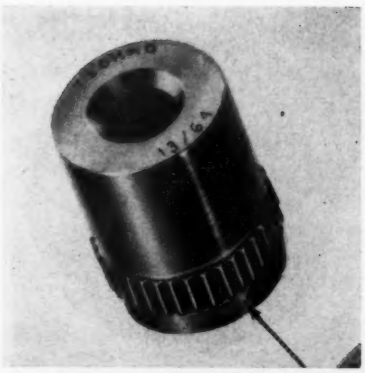


adjustable within its limiting dimension. It operates on the rolling mill principle and imparts the same qualities to the metal as a rolling mill. Fenn Mfg. Co., Newington, Conn., or **Circle Inform-A-Gram No. A29.**

A Flame Heating Machine features a functional, flat bed design having a large, flat, open area on which any of a wide variety of work handling

fixtures can be mounted. The machine simultaneously spot-hardens the cup and pad sections of automotive rocker arms, six at a time. The Cincinnati Milling Machine Co., Cincinnati 9, or — **Circle No. A30.**

A Flar-A-Lock Drill Bushing for laminated plastic drill tools is designed to permit a secure press-fit installation after the laminating process is complete. In one quick action the bushing is squeezed into the drilled hole location until the shank end is seated on a stationary flaring tool placed underneath. Conventional installation methods can also be used. Techno-Products Corp., 143 Netherwood Dr., Springfield, Pa., or —
Circle Inform-A-Gram No. A31



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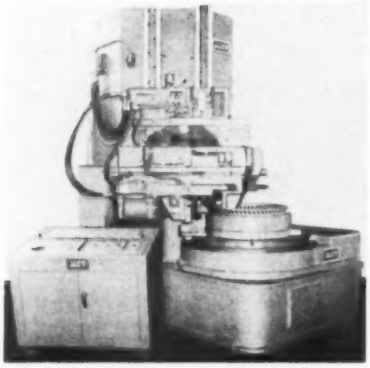
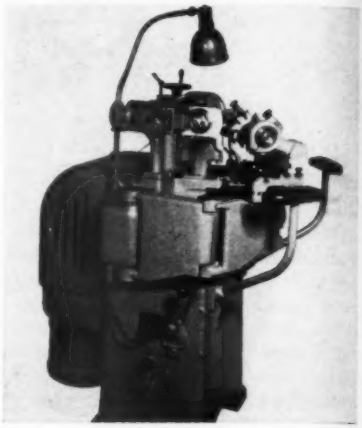


A Version of the Jacy Precision Index and Pierce machine featuring an index table which is accurate to seconds of arc is available in tonnages up to 65 tons. It is used to perforate or form annular rings varying in size from 16" to 54" in diameter. The index table features infinite resolution from 1:21,600 divisions of a circle. The Jacy table is provided with automatic and manual control and has a solid mechanical lock with zero backlash in all positions. This eliminates the need for cams, index plates, change gears, etc. Modern Engineering Service Co., 2695 W. 12 Mile Rd., Berkley, Mich., or —
Circle Inform-A-Gram No. A32.

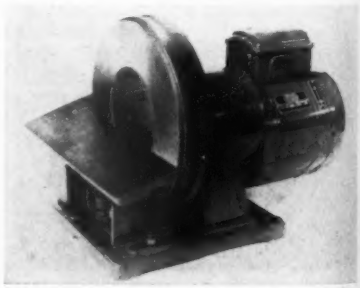
A Swiss Form and Cutter Grinding Machine provides for reliable, sharp, edge pointed teeth on nearly any type of cutter. The machine allows generation of the profile by grinding a land on the periphery of the teeth.



Cam relieved cutters and contour grinding of carbide tipped profile milling cutters can also be handled. The Olkon Corp., 13823 W. Eight Mile Rd., Detroit 35, or —
Circle Inform-A-Gram No. A33.

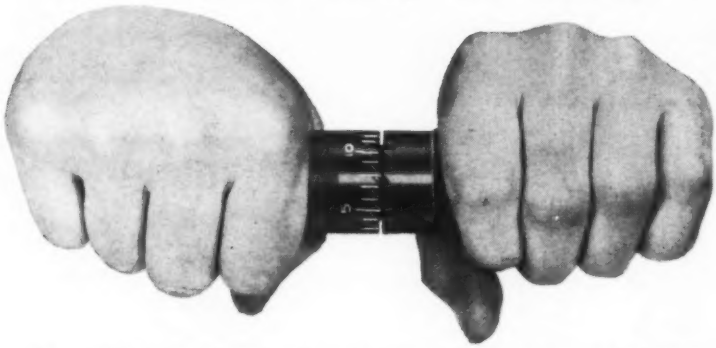
More Cuts Per Grind, and higher cutting speeds on very abrasive nonferrous metals, such as aluminum, bronze castings, cast iron, etc. are possible when using solid carbide blades in Clark adjustable spotfacers and counterbores. Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif., or —
Circle Inform-A-Gram No. A34.

Cut Time and Labor Costs of hand-filing with an R-Filemaster. It marks 3 to 10 times faster cutting action for such production and toolroom tasks as filing, shaping, and milling.

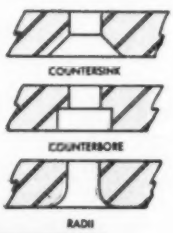


Steel, iron, copper, and brass, in form of bar stock, castings, or extrusions can be handled. Hudson Automatic Machine & Tool Co., 137-139 38th St., Union City, N. J., or —
Circle Inform-A-Gram No. A35.

MICRO-SET ACCURACY
with a twist of the wrist



Cogsdill hole finishing tools are designed to meet many precision manufacturing requirements. To assure Cogsdill customers of precision results, these tools contain a micro adjustment feature, which permits the user to adjust the tool within .001" . . . WITH A TWIST OF THE WRIST.

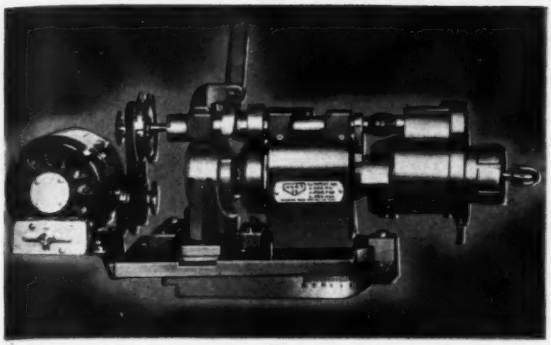


Pictured at left are three of the most common hole finishing situations. These can be accurately controlled on either front or reverse surfaces, working from whichever surface can be presented to your spindle most conveniently. In addition to these typical problems, Cogsdill tools can be designed for some facing and grooving operations . . . all incorporating the micro adjustment feature for greater finishing accuracy.

Cogsdill
TOOL PRODUCTS, INC.
12980 W. Eight Mile Road, Oak Park 37, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 128

Precision CIRCULARITY GRINDING ATTACHMENT

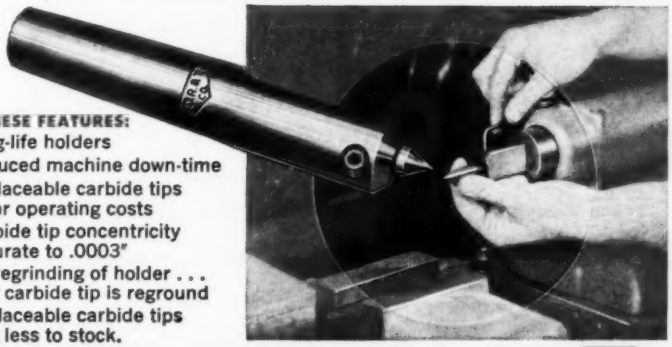


Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, a combination of form and radial relief, tapered cylindrical and straight cylindrical.

Model 500 Circularity Grinding Attachment is faster—easier to handle—has positive control—greater adaptability—rugged construction—is engineered and built to provide the finest precision work.

You Can Grind Tools Like These On A DETROIT REAMER CIRCULARITY GRINDING ATTACHMENT

Grip-Tip CENTERS–Replaceable Carbide Tips



CHECK THESE FEATURES:

1. Long-life holders
2. Reduced machine down-time
3. Replaceable carbide tips lower operating costs
4. Carbide tip concentricity accurate to .0003"
5. No regrinding of holder . . . only carbide tip is reground
6. Replaceable carbide tips cost less to stock.

DETROIT REAMER & TOOL CO.

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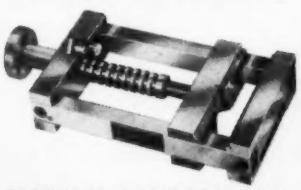
CIRCLE INFORM-A-GRAM KEY NO. 1291

ESSENTIAL



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Producto's Precision Toolroom Vise is essential equipment for your jig borers, surface grinders, drill presses, tappers. It's extremely strong, yet weighs only 13 lbs. and has a 2" high frame. Has large jaw opening, will clamp heavy as well as light workpieces. All surfaces hardened and ground. Works on five surfaces. Write for Bulletin TE2-103.

THE PRODUCTO MACHINE CO.
970 Housatonic Avenue
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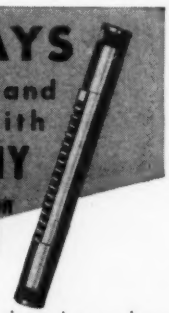
—ACCURATE and UNIFORM with
The GLENNY
Adjustable Expansion
PUSH BROACH



because . . .

this sturdy simple tool can be used on any type arbor press for continuous efficient keyways — in any quantity

COSTS OFTEN REDUCED AS MUCH AS 10 TIMES

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70 EAST 201ST STREET
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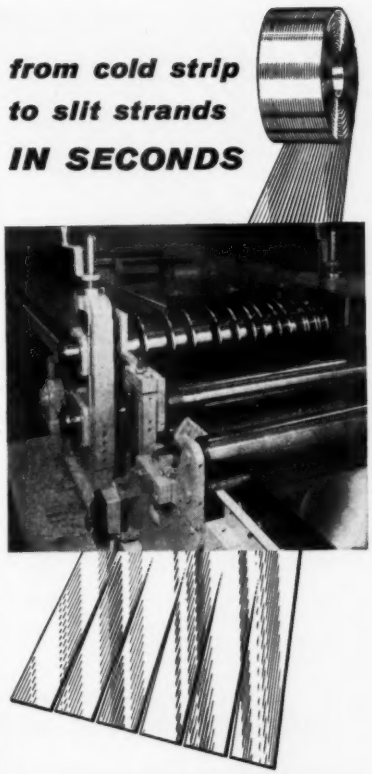
CIRCLE INFORM-A-GRAM KEY NO. 1293

from cold strip to slit strands IN SECONDS



YODER ROTARY MULTIPLE SLITTERS

A Yoder slitter converts mill-width coils of flat-rolled metal into many variable-width strands in amazingly short time. Speed, coupled with great accuracy and low manpower requirements, makes a Yoder slitter an important factor in keeping production and overhead costs down.

Operated by only two men, the Yoder Type 3-48 slitter illustrated is designed to accommodate standard mill-width coils up to 48 inches wide, in a variety of metals and thicknesses. The slit strand widths can be held to within a .004" tolerance.

Even if your steel requirements are as little as 100 tons a month, the savings to be realized in time, manpower and raw material costs alone will pay for a Yoder slitter in the first few months of operation.

There is a Yoder slitter designed and engineered to meet your requirements, and to speed the delivery of "special" width stock in a wide range of large or small sizes. Send for your free copy of the fully-illustrated, 76-page booklet, "Multiple Rotary Slitting Lines."

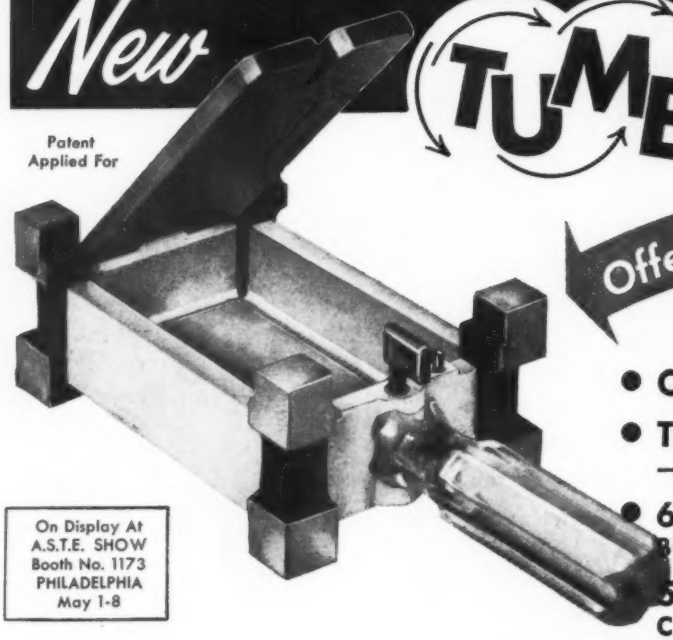
THE YODER COMPANY
5501 Walworth Avenue • Cleveland 2, Ohio

YODER ROTARY SLITTING LINES

CIRCLE INFORM-A-GRAM KEY NO. 1294

New TUMBLE BOX JIG

Patent Applied For



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Offers Many Big Advantages

AVAILABLE IN **47** SIZES

- **ONE-HALF THE WEIGHT**
- **TRI-METAL CONSTRUCTION** —ALUMINUM—CAST IRON—STEEL
- **6-SIDE UTILITY**—CAN USE HEAD-TYPE BUSHINGS, ON SIDES, TOP, BOTTOM
- **6 HANDLE LOCATIONS**—HANDLE CAN BE ATTACHED TO ANY SIDE OR BOTTOM
- **ONE HAND OPERATION**—THUMB SCREW RELEASES LID INSTANTLY
- **LEAF "POP-UP"**—AUTOMATIC ACTION SPRING PLUNGER SNAPS LID OPEN
- **STABLE**—RUGGED CONSTRUCTION

Standard Parts is First with Exclusive New "TUMBLE" Jig

Light Weight and Ease of Handling Boost Production, Cut Operator Fatigue

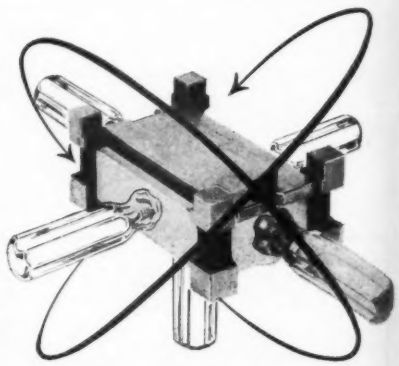
New design features, new engineering concepts, new construction techniques . . . . are incorporated in this outstanding line of "Tumble" Box Jigs. By combining 3 metals—aluminum, cast iron, steel—half the weight has been eliminated. This increases efficiency and production. The sturdy handle (can be located on any side) makes tumbling fast, easy and safe.

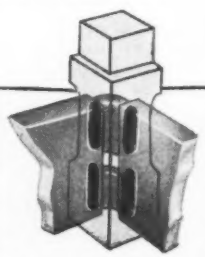
Bushings can be used on all 6 sides. A unique interlocking feature is the aluminum through the cast iron legs, which assures strength and stability. Walls can easily be machined without distorting the Jig. 47 Sizes available 1" x 1" x 1" to 4" x 8" x 4".

Full size Tracing Templates are available for all 47 sizes.

HANDLE (as illustrated) may easily be attached on any side or bottom of the jig as needed.

TUMBLE—Universal tumble direction (as illustrated) is advantage of this lightweight jig — where handle can be located where desired.





Interlocking Leg Joint

Aluminum goes all the way through the cored slots in the cast iron legs—forms a unified, interlocking joint — assuring light weight, but rugged strength.

Ask For TUMBLE JIG Bulletin, Sizes, Prices.

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4	23	42	61	108	141	1181	1321	1431	1523	1604	1674
5	24	43	63	109	142	1182	1322	1432	1541	1605	1681
6	25	44	64	111	145	1183	1323	1433	1542	1611	1682
7	26	45	66	113	146	1211	1351	1441	1543	1612	1683
8	27	46	91	115	149	1212	1352	1442	1561	1631	1684
9	29	47	93	119	150	1213	1353	1443	1562	1632	1691
10	30	48	94	120	153	1251	1354	1471	1571	1633	1692
11	31	49	95	122	155	1252	1361	1472	1572	1634	1693
12	32	51	96	123	159	1253	1362	1473	1573	1641	1694
13	33	52	97	124	162	1254	1363	1481	1574	1642	1771
14	34	53	98	127	171	1255	1364	1482	1575	1643	1772
15	35	54	99	128	250	1261	1391	1483	1576	1644	1781
17	36	55	101	130	300	1262	1392	1511	1581	1651	1782
18	37	56	103	131	1161	1263	1393	1512	1582	1662	1783
19	38	57	104	133	1162	1291	1401	1513	1583	1663	1784
20	39	58	105	134	1163	1292	1402	1514	1601	1671	

EDITORIAL ITEMS

A1	A19	A37	A55	A73	B8	B26	B44	F1
A2	A20	A38	A56	A74	B9	B27	B45	F2
A3	A21	A39	A57	A75	B10	B28	B46	F3
A4	A22	A40	A58	A76	B11	B29	B47	F4
A5	A23	A41	A59	A77	B12	B30	B48	F5
A6	A24	A42	A60	A78	B13	B31	B49	F6
A7	A25	A43	A61	A79	B14	B32	C1	F7
A8	A26	A44	A62	A80	B15	B33	C2	F8
A9	A27	A45	A63	A81	B16	B34	C3	F9
A10	A28	A46	A64	A82	B17	B35	C4	F10
A11	A29	A47	A65	A83	B18	B36	C5	F11
A12	A30	A48	A66	B1	B19	B37	C6	F12
A13	A31	A49	A67	B2	B20	B38	C7	F13
A14	A32	A50	A68	B3	B21	B39	C8	
A15	A33	A51	A69	B4	B22	B40	C9	
A16	A34	A52	A70	B5	B23	B41	C10	
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A7	A25	A43	A61	A79	B14	B32	C1	F7
A8	A26	A44	A62	A80	B15	B33	C2	F8
A9	A27	A45	A63	A81	B16	B34	C3	F9
A10	A28	A46	A64	A82	B17	B35	C4	F10
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A13	A31	A49	A67	B2	B20	B38	C7	F13
A14	A32	A50	A68	B3	B21	B39	C8	
A15	A33	A51	A69	B4	B22	B40	C9	
A16	A34	A52	A70	B5	B23	B41	C10	
A17	A35	A53	A71	B6	B24	B42	C11	
A18	A36	A54	A72	B7	B25	B43	D1	

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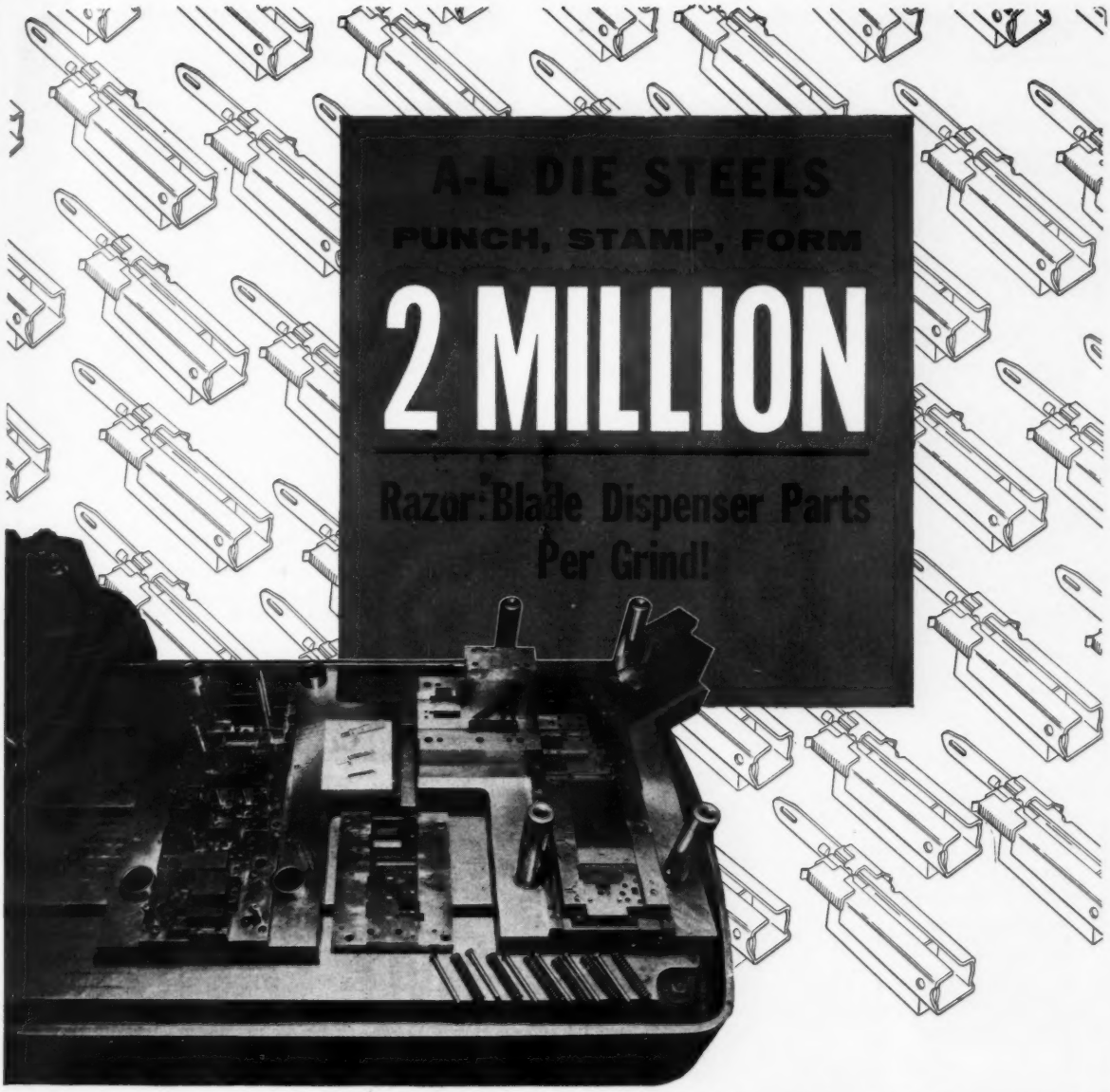

Punching, stamping and forming parts of this die are of air-hardening Allegheny Ludlum ONTARIO—heat treated to 61-62 Rockwell C. Slides, frames and cams are of A-L DEWARD oil-hardening die steel —heat treated to 61-62 Rockwell C.

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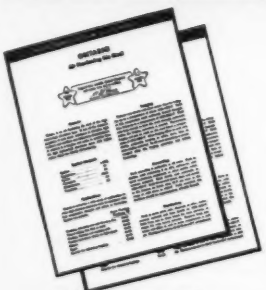

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Eliminates Need for All Special Hole Gages!

MEASURES ALL BORES

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DIAMETERS .057" to .828"

DIATEST is a complete comparator gage with rings and measuring heads built around a *ten-thousandths* dial indicator.

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Rod (not shown) pushes ball through unfinished hole.
Precision ball of tungsten carbide, slightly larger than finished hole.
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- FAST. Takes only seconds. Well suited to automation.
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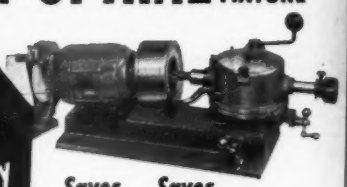

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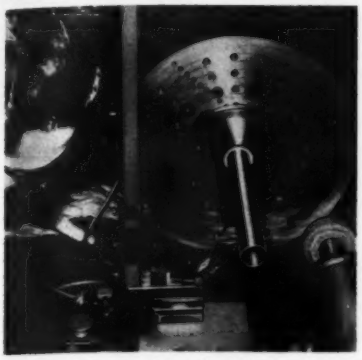
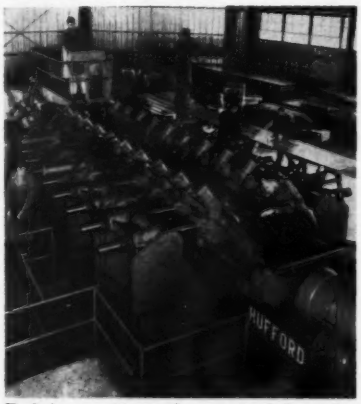
A Cylinder Square, an inspection tool, speeds up and increases the accuracy of various checking operations on toolrooms, inspection and receiving departments, and in machine



setup. It is used in checking squareness, concentricity, run-out, etc., of parts, shafts, spindles, bores, and similar objects. The large model is 7½" dia and 14" long. AA Gage Co., 350 Fair St., Detroit 20, or —
Circle Inform-A-Gram No. A36.

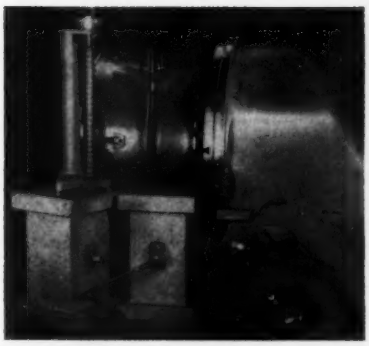
A Two-Way Stretch-Forming Machine can handle 5' x 24' sheets in which the stiffening ribs have been extruded and holds close tolerances. The Bi-Axial stretch forming machine grips work along all four sides.



End jaws allow the material to be pre-curved to approximate contour before stretching. The Hufford Corp., 1700 E. Grand Ave., El Segundo, Calif., or —
Circle Inform-A-Gram No. A37.

Bearing Failure, fatigue, chatter, vibration, wear, and noise are eliminated with the multi-purpose system for cost saving machinery maintenance and quality control. Checking for vibrations, finding imbalance, misalignment, and dynamic balancing are performed by this system. International Research and Development Corp., 797 Thomas Lane, Columbus, Ohio.
Circle Inform-A-Gram No. A38.

Eliminate Erroneous Readings caused by vibration or chatter using granite riser blocks. Accurate height gage readings on parts with higher than normal check points can be accomplished. An air lift feature permits finger-tip control of the 300-lb blocks which provide an accurate granite surface parallel to the working surface plate and at an elevation sufficient to allow use of standard height gages. The Herman Stone Co., 1860 N. Gettysburg Ave., Dayton, Ohio, or —
Circle Inform-A-Gram No. A39.



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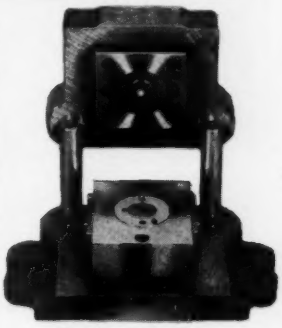

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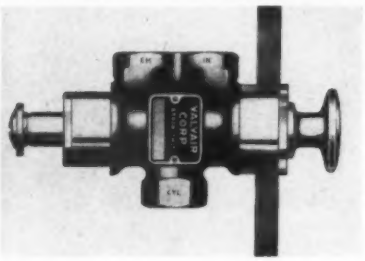
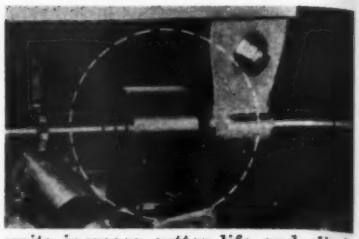


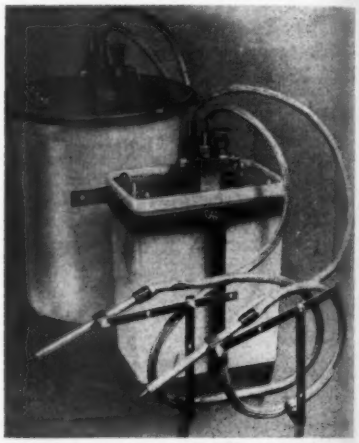
additional features of the valves, which give up to 200 psi pneumatic and hydraulic or vacuum service. A variety of 1⅜" dia control knobs in stainless steel and long-shanked knobs, of 1¼" dia are available. Valvair Corp., 454 Morgan Ave., Akron 11, Ohio, or —
Circle Inform-A-Gram No. A40.

Eliminate Constant Bushing Wear and Maintenance with a packaged support unit. It holds precision indefinitely at greatly increased speeds and feeds to take full advantage of carbide cutters. In addition, the



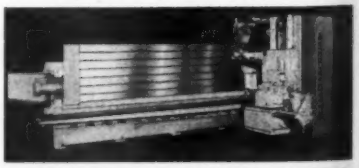
units increase cutter life and eliminate cutter breakage, twisted arbors, frozen bushings, and chatter. Running at low temperatures, these units eliminate tolerance requirements for heat expansion. Donley Products, Inc., 11106 Avon Ave., Cleveland 5, or—**Circle Inform-A-Gram No. A41.**

A Mist Coolant System is ruggedly constructed with corrosion-proof heavy-duty molded polyethylene containers. Dual outlets with precisely machined nozzles give a fine



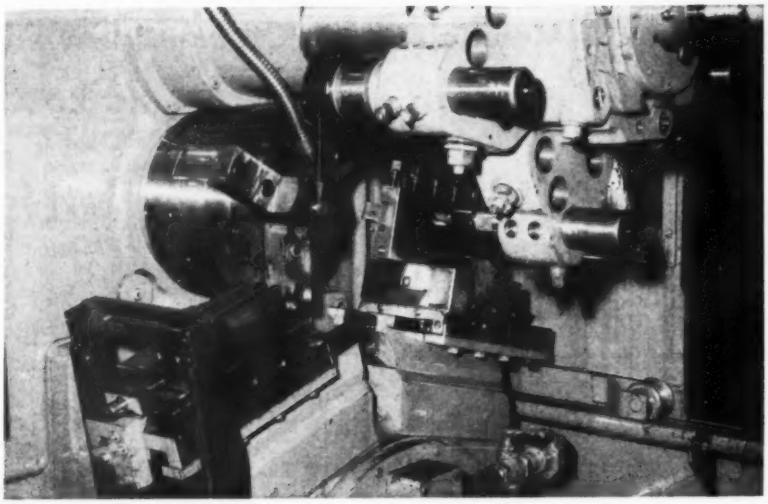
narrow cone spray for maximum cooling and air economy. The systems are available in 1 and 2½ gal sizes. Graymills Corp., 3705 N. Lincoln Ave., Chicago 13, or —
Circle Inform-A-Gram No. A42.

Hydraulically Driven Sculpture Machines for easier and faster tracer-controlled contour and profile milling are now available from the Colonial-Romulus Div'n, Colonial Broach and Machine Co., Parkgrove Station, Detroit 5. Spindle speeds



are infinitely variable from 36 to 1900 rpm. The machines permit true three-dimensional duplication at maximum speeds and feeds for the material being machined.
Circle Inform-A-Gram No. A43.

WARNER & SWASEY with *Buck* AJUST-TRU® POWER CHUCK
"Repeats to .0005*, reduces scrap"



If you use automatics this report from A. F. Gabriel, V-P Eng. & Prod., Acme Industrial Co., Chicago, should be of value.

"We have set up your 10" air operated chucks as standard equipment on our machines . . . many parts require repeat chuckings . . . most have extremely close concentricity requirements. With Buck chucks we can repeat to tolerances of .0005* and less . . . your chuck has allowed us to improve quality and has reduced our scrap."

It pays to chuck with Buck!
Send for catalog — see why.

* *Although Acme does better, the guaranteed precision of Buck Power Chucks is .001"*

BUCK TOOL COMPANY
118 SCHIPPERS LANE • KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 134

CIRCLE TYPE
ANCHOR BUSHING—
LAMINATE PLASTIC TEMPLATE

STANDARD TYPE
ANCHOR BUSHING—
SHEET METAL TEMPLATE

DO PRECISION FREE HAND DRILLING

WITH ANCHOR BUSHING® DRILL TEMPLATES

To eliminate inaccurate hole locations, wrong drill hole size or off-perpendicular drilling, use Anchor Bushing drill templates when doing free hand drilling to obtain interchangeability of parts and economy in high or low quantity production runs.

Anchor Bushing drill templates can be made for a fraction of the cost required for conventional drill tooling. Anchor bushings are riveted or spotwelded to sheet metal or laminated into plastic material.

Any fabrication shop can make its own dimensionally stable drill tooling to fit flat, curved or compound forms without use of expensive equipment or highly skilled labor.

Learn how to do precision freehand drilling, *write for the Anchor Bushing Catalog.*

U. S. PATENT 2483686 ON METHOD AND PRODUCT. FOREIGN PATENTS PENDING. TRADEMARK REGISTERED.

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2600 WEST 247TH STREET · TORRANCE · CALIFORNIA

Sales Representative for Kirk-Wing Company, Vega Baja, Puerto Rico.

CIRCLE INFORM-A-GRAM KEY NO. 1351

POSITIVE GRIP • SPEED • ADAPTABILITY

Model J

AIR-POWERED TOOLMAKERS VISE
UNIVERSAL DOUBLE SWIVEL

Can be adjusted to any position without removing work from jaws. Furnished with hardened steel jaws and brass caps. Operated by a 6" air cylinder manufactured by Yost. Control kit included with each vise consisting of foot treadle valve, quick exhaust valve and 2 lengths of coupled hose. Jaws can be pre-set to any desired opening. Vise can also be operated manually. Jaw width — 4"; jaw opening — 6"; approx. wt. — 90 lbs.

Write today for bulletin on the complete Yost line

YOST MFG. CO., Cambridge Springs, Pa.

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PRECISION TOOL ROOM SHAPER
GUARANTEED ACCURACY ±.00025"

with the **JEMCO H-20 tool room shaper**

- Accommodates wide variety of precision work within a range of 8" x 11¾"
- Accurate to within ±.00025" within 6"
- Changes strokes by switch control to either 60 or 120/min.

EXCLUSIVE TERRITORIES OPEN

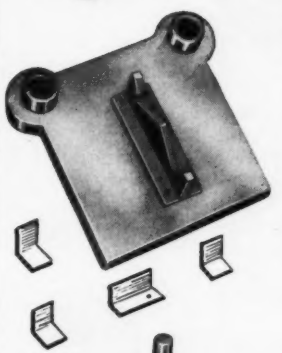
write for complete information and prices

Jersey manufacturing company
401-B LIVINGSTON ST. • ELIZABETH 1, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1353

Punches and Dies

Angle Iron Cut Off Die



No. 18, cut off die, for 2" x 2" x ¼" and lighter angles. Mounted in leader pin die set. Fits 'most all makes of 25-ton and larger presses. Simple shearing action insures straight, clean cut WITHOUT DISTORTION. Another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Also adaptors and die shoes to convert your press. Each precision-made.

25th ANNIVERSARY 1933 1958

What are your punch and die needs? Consult us about your problems. Prompt service on "specials" made to your order.

Send for free illustrated catalog No. 154 AF. Net prices shown.

WARD Machinery Co. 564 West Washington **Chicago 6**

CIRCLE INFORM-A-GRAM KEY NO. 1354

template assembly can be **so simple**

with **PEM Self-Clinching Drill Bushings**

And so much less costly, too.

One-hole compression-mounting positively locks one or several bushings into template metal—in one operation.

No riveting, welding, indexing, nesting—no outboard supports needed.

High torque and pull-out resistance.

Alignment and center distances secured, automatically.

Permit thin-gauge, lightweight templates.

Save their cost in simplified assembly.

Write for literature and samples for test. Penn Engineering & Manufacturing Corp., Doylestown, Pa.

PEM

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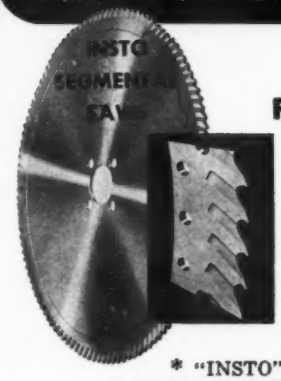
CRAFTED IN SHEFFIELD* FOR MORE CUTS PER DOLLAR



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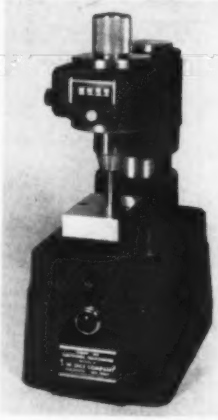
- "INSTO" Segmental Saws Available from 11" through 72"
- Cost less because of greater production
- Suitable for ferrous and non-ferrous applications
- Tungsten high-speed steel segments of unsurpassed quality
- Clean square cut with no material distortion
- Narrow Kerf allows maximum clearance for fast cutting
- Tooth design reduces friction for cooler cutting, longer saw life.

* "INSTO" segmental Saws are produced in Sheffield, England by Firth Brown Tools, Ltd., an internationally famous name in metalworking. They are serviced in Cleveland in Donley's modern saw shop. Send today for FREE BOOKLET on "Sharpening and Repairing Cold Saws".

ERNEST F. Donley's SONS, INC.
10203 Miles Ave., Cleveland 5, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1362



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Unexcelled for high-speed, direct precision measurement of anything fragile or compressible . . . conducting or non-conducting. Widely used on:

SEMICONDUCTORS • DEPOSITED FILMS
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Negligible measuring pressure. Send for BULLETIN 4005.

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HARDENED and GROUND HSS BLANKS

Any decimal diameter — any length. Mirror finish surface to gage tolerance.

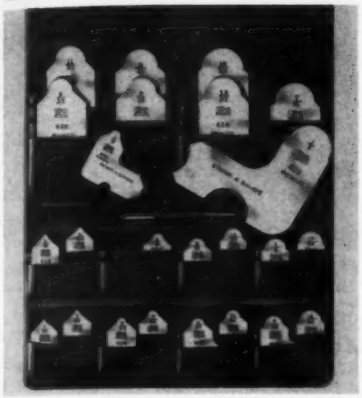
Many uses—
—core pins, punches, gages, ejector pins, insert pins, special tools, etc.—Quick delivery.

Write or phone DRexell 6-4223 for price list D-3

WILLIAM T. HUTCHINSON CO.
53 Brown Ave., Springfield N. J.

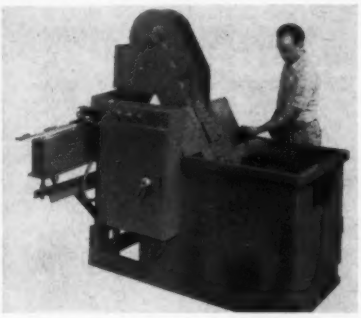
CIRCLE INFORM-A-GRAM KEY NO. 1364

Check Radii from 1/32" to 1/2" using a series of gages. Each of these No. 628 radius gages has five different gaging edges, permitting testing of



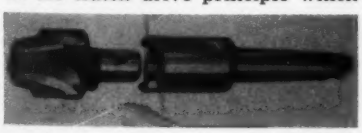
both convex and concave radii even when recessed, and making the testing of corner radii easy. Brown & Sharpe Mfg. Co., Providence.
Circle Inform-A-Gram No. A44.

Orienting Storage Feeders of 5, 10, and 20 cu ft storage capacity have been added to its line of heavy parts feeders by Campbell Machines Co., 18634 Fitzpatrick, Detroit 28. These



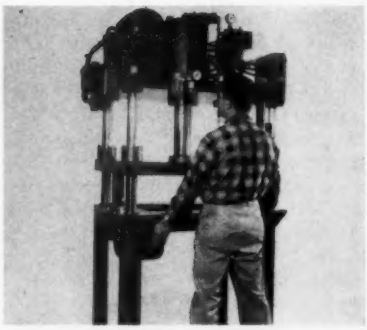
models accommodate parts from 1/8" x 1/8" x 1/4" to as large as 3" x 6" x 10". A single feeder may be tooled to feed a family of parts and production rates range up to 300 pieces/min.
Circle Inform-A-Gram No. A45.

Maintain Accurate Alignment required for mass production work using cutting tools with taper-torque drive design. This design is based on the clutch drive principle which



provides greater load carrying capacity than former drives. Five sizes of holders will accommodate cutters from 3/4" through 3 3/8" OD. Metal Cutting Tools, Inc., 301 S. Water St., Rockford, Ill., or —
Circle Inform-A-Gram No. A46.

Higher Output at Lower Costs, versatility and safety are features of the Bausenbach, high velocity, hydraulic trim-press. Typical operations of these presses include swaging, stamping, shearing, blanking, trimming, forming, and drawing. Extremely rapid cycling action is achieved with lower horsepower input. Approach speeds up to 2000 ipm ram travel. Bausenbach Hydraulics Div'n, Buffalo Metal Container Corp., 35 Roetzer St., Buffalo 11, or—**Circle No. A47.**



CUT COSTS SAVE TIME IMPROVE QUALITY

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Rubberized Abrasives

for MICRO-DEBURRING, SMOOTHING, CLEANING, POLISHING on HARD or SOFT METALS and other materials

4 grit textures
Course — C • Medium — M
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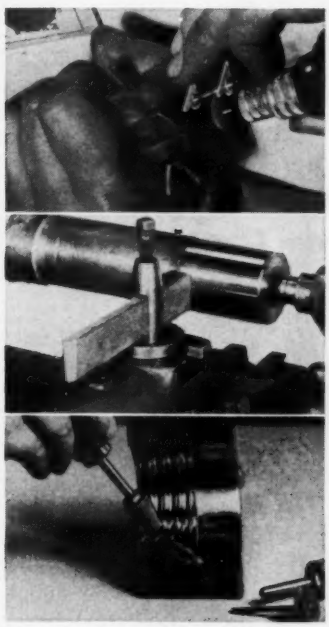
WHEELS • POINTS • BLOCKS STICKS • CONES for power or manual application and dimensional control. **CRATEX** is sold through leading industrial supply distributors.



For actual field application reports on how **CRATEX** "cushioned action" can cut costs in your own operations, send this coupon.

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☐ Aluminum
☐ Brass & Bronze
☐ Cast Iron
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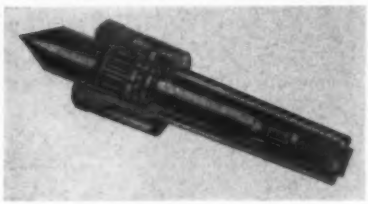
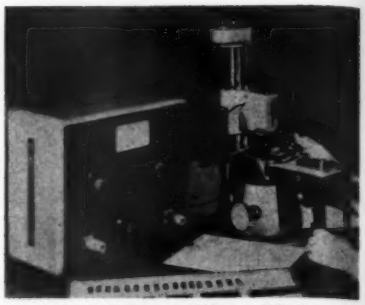
10,000 Working Hours is the approximate life expectancy of the G.S. live centers. By employing ball and roller bearings, these live centers guarantee that radial, and lateral thrust is sustained, avoiding wear and possible damage. The live centers hold runout within 0.00001" total indicator reading and need be oiled only once a year. George Scherr Co., Inc., 200 Lafayette St., New York 12, or —
Circle Inform-A-Gram No. A48.



One-Millionth of an Inch Accuracy is obtained with a new electronic gage block comparator produced by The Sheffield Corp. The Eli Whitney Dualjet gage block comparator is used to check the size of gage blocks which control dimensions for manufacture of mass produced products. Measurement is amplified either 100,000 or 10,000 times by an Accutron electronic amplifier. High magnification has a 0.000004" range and scale divisions of 0.000001". The Sheffield Corp., Dayton 1, Ohio, or —
Circle Inform-A-Gram No. A49.



Campbell
Abrasive Cutting Machines

Abrasive Cutting Know-How

Know-How is just as vital to top performance in abrasive cutting as in any other machine tool operation

Cut Titanium... Any Tough Alloy... in Seconds per Square Inch with Campbell WET, Abrasive Cutting Machines

Without Burn or Heat-Check
With Minimum Burr
With Accuracy & Fine Finish

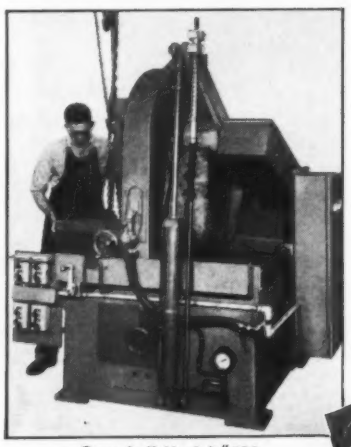
as pictured here ...at cutting speeds of 6 to 10 seconds per square inch of High-Temperature Metals or Heat-Sensitive Tool Steels.

Real economy in costly material results from straight cut, closer tolerance, small kerf loss on CAMPBELL abrasive cutting machines. (1/32" less waste per cut on a 6" bar of titanium saves about $1.50 per cut!)

For highest production rates there are automatic CAMPBELL machines...semi-automatic or manual machines for short runs.

Quality cuts...no burn or heat-checks, minimum burr, smooth finish...(with *maximum wheel economy*), are assured by such CAMPBELL features as a flood of coolant precisely applied at cut...wheel oscillation...work clamps on both sides of cut...ample power.

Capacities range from the smallest stock to 14" rounds...billets up to 12" square...plate up to 6" thick and 20 feet long.



Campbell Model #481 wet, abrasive cutting machine. Capacity up to 8" square solids and 8" O.D. tubing.

May we send you a copy of Bulletin DH-460-B? It gives complete data on 15 Campbell Machine Models

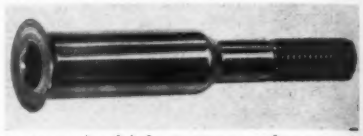
ACCO

CAMPBELL MACHINE DIVISION • American Chain & Cable

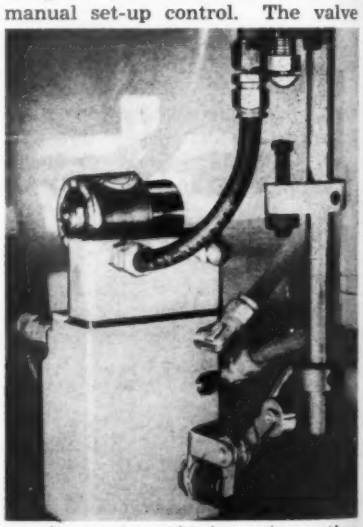
927 Connecticut Avenue, Bridgeport 2, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 138

A Light-Weight Alignment Bolt designed to re-align, through normal installation, any misalignment existing between wing panel skins, access doors and structures, etc. It effects extremely high torque values, and reduces weight approximately 50% compared to other fasteners used for this type aircraft application. The Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif., or —
Circle Inform-A-Gram No. A50.



A Four-Way Slide Valve is able to actuate a variety of air powered mechanisms and equipment, and is designed with interlock switch and manual set-up control. The valve can be used to obtain reciprocating action of double-acting cylinders with either long or short stroke, or it can control more than one mechanism. Dixon Automatic Tool, Inc., 2300 23rd Ave., Rockford, Ill., or —
Circle Inform-A-Gram No. A51.



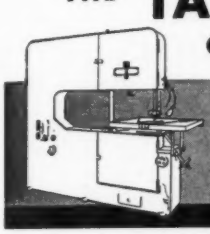
FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

FASTEST, BEST MEANS OF CUTTING METALS

If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

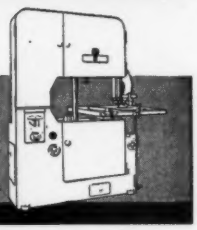
THE TANNEWITZ WORKS

GRAND RAPIDS, MICHIGAN ☎ GL-6-1729



TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES for CONTOUR SAWING, FILING, POLISHING

The smoothest, fastest, most trouble-free Di-Saws on the market. Write for bulletin.



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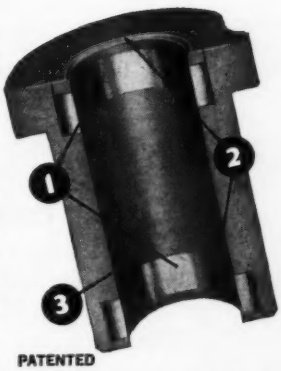
MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES IN Automation!

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 41.



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

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You **KNOW** where the holes will be . . . with

UNIVERSAL ADJUSTABLE

U.S. Drill Heads

"Shot gun accuracy" is for the birds. With U. S. Heads you pin-point your multiple-hole drilling *exactly*—position the drilling spindles for different patterns almost as easily and quickly as you read them from your prints.

Style U-1L Universal Adjustable Head provides 9" diameter drilling area. U. S. Heads cover a wide range—6" to 15" diameter drilling areas, drill sizes up to 1-1/16". Totally-sealed, lifetime-lubricated universal joints can be interchanged quickly without tools.

Immediate delivery on most sizes. Write today for complete specification data in new catalog No. AD-57.

We manufacture all types of adjustable, fixed center and individual lead screw tapping heads.

US DRILL HEAD

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BURNS STREET • CINCINNATI 4, OHIO

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PACKED Full Of FACTS

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SILVER BRAZING with PREFORMS

Now . . . in one complete 16 page booklet all the latest information on how to increase production, save time with brazing preforms.

Complete information on NO-TANGLE NOTCH COIL RINGS — how they provide new efficiency and new economies in handling alloys.

Helps you select the proper PREFORM for the job. Contains charts that illustrate the type joint, recommended PREFORM and simple ordering data.

Gives the complete line of EDGEWOUND AND BLANKED WASHERS, and silver brazing and soldering alloys available.

Helps you get quick, accurate alloy calculation with calculating tables for all commonly used alloys.

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LUCAS MILHAUPT
ENGINEERING COMPANY

CIRCLE INFORM-A-GRAM KEY NO. 1401

REID TOOL ROOM *Accessories*

Compression Spring Assortment

Made from music wire. All sizes in diameters 3/32" to 1-1/2". All 10" long. Select the size required and cut to length wanted. Saves time and money.

Extension Spring Assortment

Made from music wire. All sizes in diameter 1/8" to 1". All 11" long with loop or hook at both ends. Cut to length desired.

FREE 64 Pg. Catalog

Listing numerous tool room needs such as plastic and steel ball handles, machine handles, hand wheels, hand knobs, etc.

Quality at Moderate Prices!

FREE 64 Pg. CATALOG

REID TOOL SUPPLY CO. Muskegon Heights, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1402

TIME SAVERS for the TOOL ROOM

. . . and the production line

Do It Faster With A DREMEL MOTO-TOOL

For top-speed, top-precision grinding, polishing, and burring, low-cost Dremel Moto-Tools are your best practical buy. Use them in tool and die work, pattern making, burring operations, and dozens of other applications. They're light and easy to handle. Give you quick access to areas inaccessible for larger grinders. Cool-running universal motor develops 27,000 RPM. Smooth operation permits precision accuracy in close-tolerance work, eliminating costly and painstaking hand work.

Model No. 2 Moto-Tool only **$19.95**

Model No. 2 Moto-Tool Kit, with 23 accessories, including high-speed cutters, in steel storage case **$27.50**

See Your Industrial Supply Dealer or Write to

DREMEL MANUFACTURING CO., Dept. 528A, Racine, Wis.

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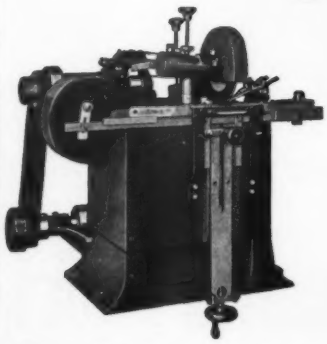
RESHARPEN YOUR SAWS

Over and Over Again



Wardwell "EC" Combination Grinder will sharpen a gross of Hack Saw Blades at least 6 times, thus saving the price of the machine.

Only grinder that does not depend on shape of grinding wheel to form shape of teeth.

Write for Bulletin EC

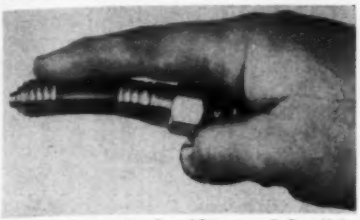
Sharpens Hack, Band or Circular Saws

WARDWELL
3809 Ridge Road
Cleveland 9, Ohio

MAKER OF LARGEST LINE OF SAW AND TOOL SHARPENING MACHINES

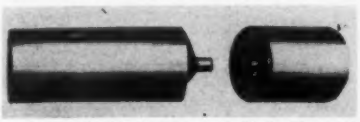
CIRCLE INFORM-A-GRAM KEY NO. 1404

Mere Finger Pressure in controlling air volume is possible with the Air-Lok. Without buttons, handles, levers, or gimmicks, the Air-Lok has a non-removable and non-losable



tip with standard orifices and flexible neoprene body for easy flexing. It has durable ¼" or ½" fittings and an improved air shut-off valve. Toolcraft Products Co., P. O. Box 92, S. Pasadena, Calif., or —
Circle Inform-A-Gram No. A52.

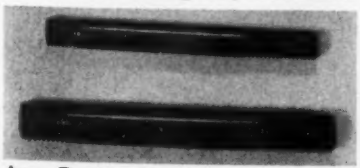
Thread-Hole Forming Punches and Die Buttons produce a screw receiving element directly in flat or curved surface sheet metal. With each stroke of the press, these buttons



punch a hole, lance a radial slit and form surrounding metal into a spiral cone that conforms to pitch of screw thread. Richard Bros., Punch Div'n, Allied Products Corp., 26500 Capital Ave., Detroit 39, or —
Circle Inform-A-Gram No. A53.

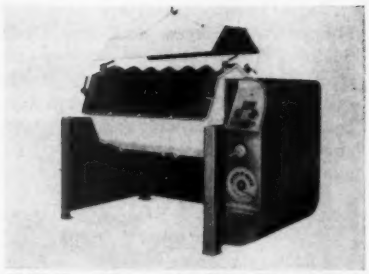
A Material Outwears Steel 60:1 yet can be cast without heat or pressure. The Devcon WR resists most acids, alkalies, solvents, and other chemicals, and has proved helpful for repairing chemical equipment as well as building up surfaces subject to severe wear and forming dies. Supplied in paste form, the material becomes a thick liquid when a hardening agent is added, making it easy to be cast or poured into a variety of shapes. Devcon Corp., Danvers, Mass., or —
Circle Inform-A-Gram No. A54.

Fatigue and Wear Resistance are features of Stressproof steel studs made available by Northwestern Tool & Engineering Co., 116 Hollier

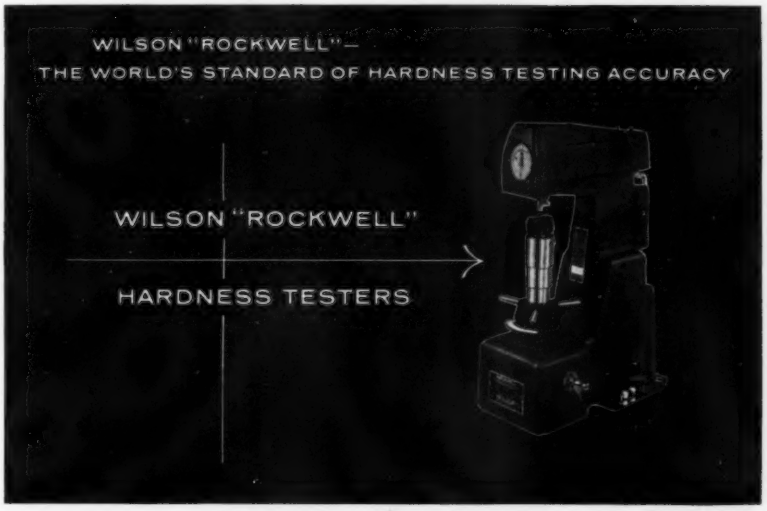


Ave., Dayton 3, Ohio. These studs are now available in ¼" through 1" dia. They range in lengths from 1½" to 20". **Circle No. A55.**

Multi-Use Barrel Finishing Equipment is capable of doing many jobs. Barrel sizes range up to 120" ID and can be used as single cavity barrel; by inserting an optional compartment type container into the main barrel, it provides six or more separate divisions each capable of holding a different job; or by placing in the single cavity a custom-designed holding fixture to which large workpieces may be attached, it will handle 118" parts. Speed-D-Burr



3613 San Fernando Rd., Glendale 3, Calif., or — **Circle No. A56.**



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Write for one or all of these booklets
DH-325
DH-326
DH-327

CIRCLE INFORM-A-GRAM KEY NO. 141

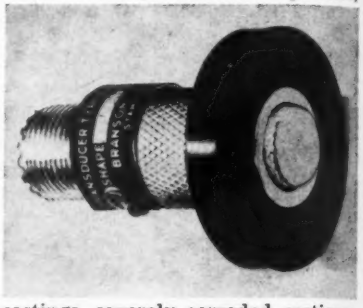
Turn Large Diameters and odd-shaped workpieces with the Model 6049F. This machine swings 60" over the ways and 49" over the cross-slide. The headstock is driven by a 40-hp motor and has 24 spindle speeds in true geometrical progression, ranging from 6 to 750 rpm, with

3 to 375 rpm alternate, forward, or reverse. Axelson Mfg. Co., Div'n of U. S. Industries, Inc., 6160 S. Boyle Ave., Los Angeles 58, or —
Circle Inform-A-Gram No. A57.

Hard Face Metal Surfaces for protection against abrasion and wear with Kenplate. This material consists of small hexagonal plates of cemented tungsten carbide assembled in a continuous pattern on an adhesive backing. The flexible backing can be cut or joined in multiples to form practically any required size or shape to cover both

flat and curved surfaces. Kennametal Inc., Latrobe, Pa., or —
Circle Inform-A-Gram No. A58.

An Ultrasonic Testing Transducer with increased sensitivity has been developed by Branson Instruments, Inc., 40 Brown House Rd., Stamford, Conn. Lead, laminated plastics,



castings, severely corroded sections, and other poor transmitters of ultrasonic energy can be tested by these Type Z transducers.
Circle Inform-A-Gram No. A59.

Machine Graphite and other abrasive materials with a ceramic cutting tool. Because of its great wear resistance, there is better size control on long workpieces. These tools, made of an aluminum oxide composition, are a supplement to conventional tools. Norton Co., Worcester 6, Mass., or —
Circle Inform-A-Gram No. A60.

A Deep-Throat 10" Clamp is a heavy duty tool which has been added to the Saxton Kant-Twist clamp line. The side plates of this clamp are wider than the other deep-

throated clamps making it a high-capacity tool. It will reach deeply into a clamping problem to give the same efficiency as other clamps. Saxton Mfg. Co., 1517 N. Potrero Ave., El Monte, Calif.
Circle Inform-A-Gram No. A61.

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Micro-Height "2" ...3" direct capacity. Without scriber, only $36.50. Risers extend capacity to 9".

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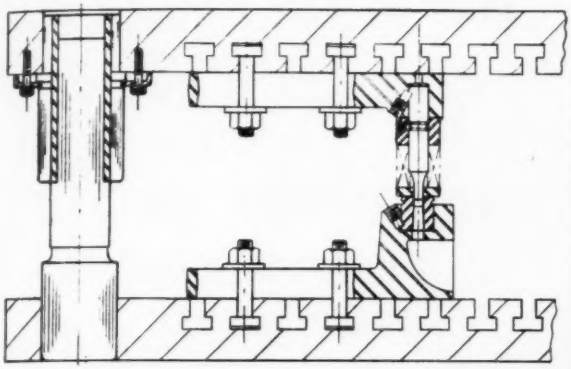
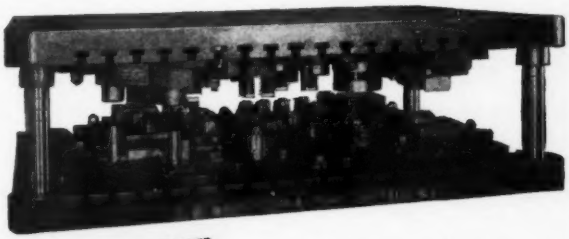
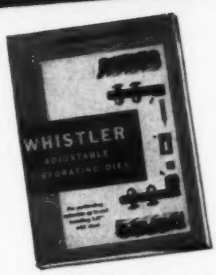


Above: Sectional drawing of a Whistler adjustable punch and die unit assembled in T-slot die set. **Below:** A completely assembled Whistler adjustable die ready for the press.





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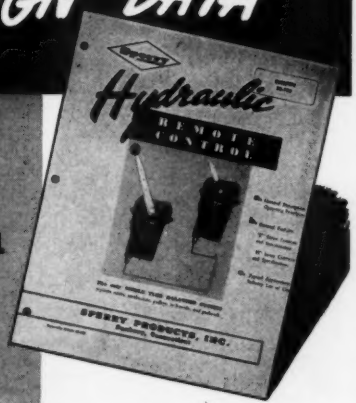
DESIGN DATA



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Protect Valuable Gages and precision and/or cutting tools in a storage cabinet. It occupies only 2.9 sq ft of floor space yet provides up to 70 sq ft of storage space, holding as many as 1,092 tools. Systematic indexing of drawers and compartments offers maximum convenience. M & S Equipment Co., Inc., 380 Darwin Dr., Snyder 26, N. Y., or —
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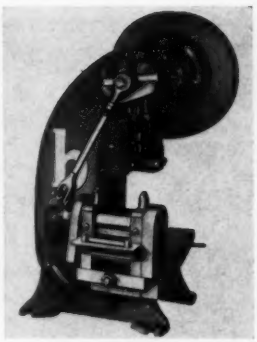
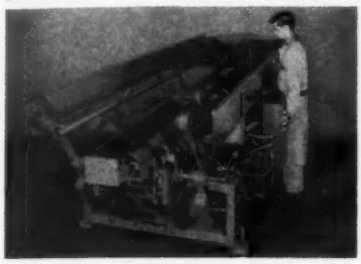


Handle Large Stampings in pressrooms with a standard slide-type combination unloader, transfer, and feeder unit. This portable, packaged automation unit is tied in with the press controls. It features an unload



and transfer method in which the stamping is under control at all times. Press Automation Systems, Inc., 25418 Ryan Rd., Centerline, Mich., or —
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An Automatic Counting Device is highly accurate and specifically designed for any operation controlled by hydraulic action. It outwears and out performs mechanical count-

ers, and there is no overtravel to damage counters and no undertravel for half or miscounts. The five digit counter registers up to 300 counts/min. Pneumaticount, 3400 N.E. 54th Ave., Portland, Ore., or —
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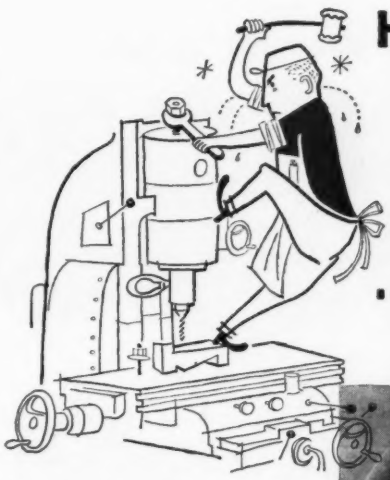

HOW MODERN IS *YOUR* METHOD?

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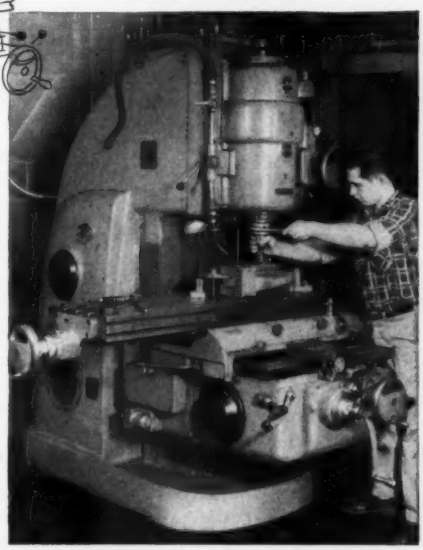
... or *THIS*



The modern P.D.Q. tooling method completely eliminates the time lost in changing old fashioned type tools. No more "sweating out" loosening and tightening the draw bolt. A 60° turn of the lock nut and you're ready for another tool. P.D.Q. tool changes are only a matter of *seconds*... and tools are available in very small, small, medium and large series depending on the application. Write for literature covering all the advantages of modern, cost cutting P.D.Q. (Portage Double Quick) tooling.

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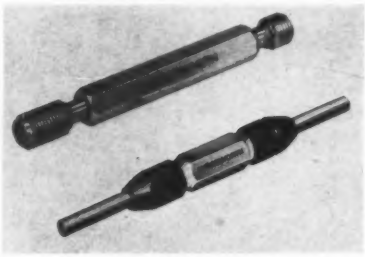
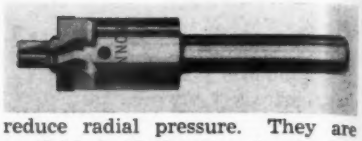
CIRCLE INFORM-A-GRAM KEY NO. 145

Long Wear Durplate Chome Thread Work Plugs are now available from N. A. Woodworth Co., 1300 E. Nine Mile Rd., Detroit 20. Both taperlock and reversible in sizes from No. 0 to 1½" in American National coarse, fine, and extra fine series are available. Gage life is increased over that of steel.
Circle Inform-A-Gram No. A66.



Heavy Duty Port Contour Cutters for producing the AND 10050 hydraulic port contour cutter in steels, including stainless, is now available from the Sonnet Tool and Mfg. Co., 576 N. Prairie Ave., Hawthorne, Calif. The cutter produces the AND 10050 contour in a single pass, and an opposed flute design is utilized to reduce radial pressure. They are available in 13 diameters for all sizes of fittings used with ⅛" through 2" dia tubing.
Circle Inform-A-Gram No. A67.



7500-Lb Dies can be handled by an electrically-powered JackStacker walkie materials handling truck. The platform-type truck, which is equipped with a hydraulic pusher and puller, can high stack dies in storage racks, as well as transport and place them directly in press beds. Lewis-Shepard Products, Inc., 125 Walnut St., Watertown 72, Mass.
Circle Inform-A-Gram No. A68.

A Water-Graphite Die Lubricant for application to extrusion dies and permanent molds is available. There is no manual mixing or stirring required because the action of the water being poured usually makes the lubricant, Graphite Suspension No. 74, ready for use. Joseph Dixon Crucible Co., Jersey City, N. J., or —
Circle Inform-A-Gram No. A69.

Solid Carbide Internal Grinding Tools designed for high speed operation to remove more stock faster without loading, less heat, and no dressing. These tools, operating at recommended speeds of 2000 to 3000 sfpm, are adaptable to most jig and standard internal grinders. Raymac Div'n, Dexco Corp., 15490 Dale Ave., Detroit 23, or —
Circle Inform-A-Gram No. A70.

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This equipment saves dollars of valuable toolroom time on every job. Set-ups that require *hours* by other methods take just *minutes* the Robbins way. Set up to machine, grind or inspect any angle in just four simple steps: (1) Look up required angle in Table of Constants furnished with unit, (2) Select gage blocks indicated, (3) Place blocks between base and sine bar swivel block, (4) Secure the work . . . and you're ready to go!

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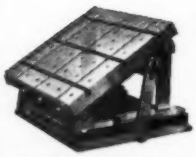

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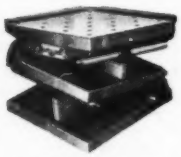

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Drillmation's hydraulic, locked-circuit feed Drilling and Tapping Units are the finest and most completely self-contained of any similar unit available today. Drillmation also offers more essential and exclusive features. Write TODAY for literature.

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- **DULL TOOL CONTROL** Unit will withdraw tool from work and indicate to operator when tool becomes dull.
- **RAPID TOOL CHANGE** Tool may be replaced without changing the controls.
- **UNIFORM TIME CYCLE** Maintains comparatively constant time cycle even when tools become dull.
- **SELF-CONTAINED HYDRAULIC SYSTEM** Delivers only the oil pressure required to overcome machining resistance.
- **COMPLETELY AUTOMATIC** Enclosed electric controls. Unit is "Fail Safe".
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- **FEED CONTROL** Infinitely variable and positive feed rate.
- **RAPID APPROACH AND RETURN** Variable irrespective of RPM.
- **MICRO DEPTH CONTROL** Depth will repeat within .0005 inch.
- **EMERGENCY QUILL RETURN** Button on front of unit. Aid in setting tools.
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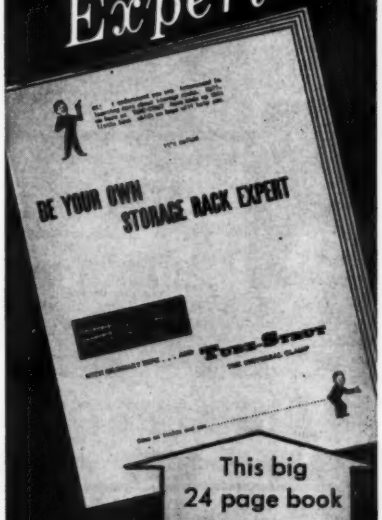

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- in ½ the time
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A practical handbook that gives step by step instructions on storage rack design and construction. You'll be amazed at how easily, quickly and economically you can convert ordinary pipe into practical, successful storage racks that meet every requirement.

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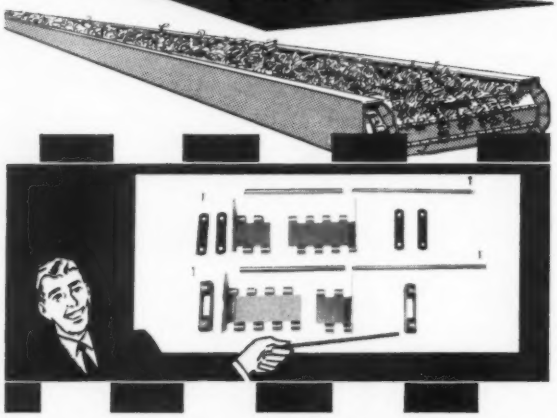
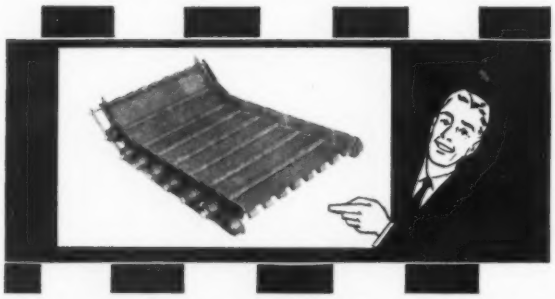
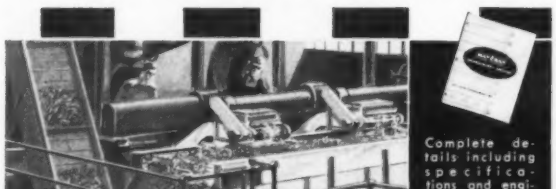


May-Fran Hinged-Steel Belting is assembled from mass-produced components to form a materials handling belting of almost any width,



length or contour to meet individual specifications. Links are joined by means of steel rods . . . links, wings and side chain become integral unit.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Precision formed steel links are assembled in horizontal rows and joined by high-carbon steel tubes and connecting rods. These rods are fastened to side chains to support the belt links so they "float" freely, and side chain takes all tension. Wings remain positively engaged and in continuous overlap at all times, even over sprockets.

MAY-FRAN ENGINEERING, INC.
1726 Clarkstone Road • Cleveland, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1481

You can't go wrong
in buying Granite Surface Plates
if you follow these rules . . .

1. Be sure that surface plates are TRUE QUARTZ GRANITE, which is unequalled for surface plate performance. (In some cases, black diabase is being classified as "granite").
2. Look for *clearly defined accuracy.* Get a full explanation as to maker's method of expressing flatness.
3. Investigate for *wear resistance* properties.
4. Don't be misled by claims pertaining to such irrelevant factors as "high compressive strength". (The truth is that all granites possess far more compressive strength than is ever needed for surface plate use).
5. As in everything else, be guided by the reputation of the manufacturer.

We invite you to apply this check-list against Bryant Rock-of-Ages "TRUE" Granite Surface Plates. You'll find that these surface plates are the finest in every respect. This is because Bryant Rock-of-Ages Surface Plates, made of premium granite from the world's largest quarries, are finished *on the head of the grain;* and because their accuracy and satisfactory performance are guaranteed by two of the leading names in American industry. Write today for free folder.

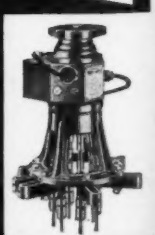
BRYANT GAGE & SPINDLE DIVISION
Box 620H Springfield, Vermont
DIVISION OF BRYANT CHUCKING GRINDER CO.
Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers

CIRCLE INFORM-A-GRAM KEY NO. 1482

★ AUTOMATIC TAP REVERSAL
★ FITS ANY DRILL PRESS
★ PRECISE DEPTH CONTROL

MULTI-TAPPER simultaneously handles different tap sizes and pitches—can be set up for automatic or semi-automatic operation. Makes any drill press a production tapping tool.

Want a demonstration in your plant? Write us and we'll arrange it with your nearby Commander Distributor. Ask for your copy of the new Commander Production Tool Catalog.



Commander MFG. CO.
4226 W. KINZIE ST. CHICAGO 24, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1483

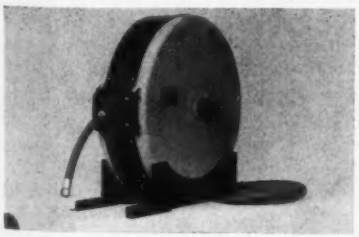
A Completely Automatic Loader and Unloader for the Gleason No. 16 and No. 26 quenching presses is now available. The load and unload mechanism is cam controlled and a

Geneva plate indexes the arms of the unit from the load to unload position. This unit assures positive control of quality. Gleason Works, 1000 University Ave., Rochester 3, N. Y., or — **Circle No. A71.**

A Machine For Cutting, Beading, joggling, flanging, edgebending, dishing, and nibbling is offered by American Pullmax Co., Inc., 2455 N.

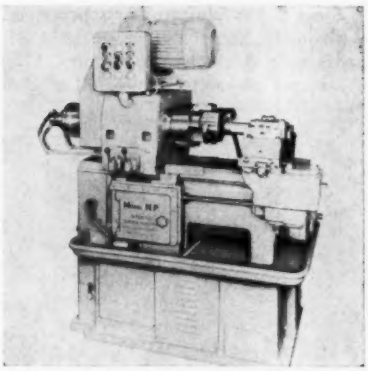
Sheffield Ave., Chicago 14. The P-7 has a cutting capacity of 9/32" mild steel and will also work stainless, non-ferrous metals, wire mesh, and many types of plastic sheet.
Circle Inform-A-Gram No. A72.

Use An Industrial Hose and Cable Reel Unit with compressed air, industrial gases, liquids, and chemicals. The Model A-2 features the universal type mounting bracket which permits easy installation on wall, floor,



ceiling, or mobile equipment. It has a capacity of 50' of ½" ID single hose. United Specialties, Inc., Main and Mosby Sts., El Dorado, Ark., or **Circle Inform-A-Gram No. A73.**

Spindles in a Boring Machine may be driven by separate precision balanced motors when different spindle speeds are required, or a single motor with tandem drive. This is one of the features of Model NP which has a 9⅝" x 19" table, 16" swing over the table, and 0.0005" to 0.054" boring feeds/min. Seneca Falls Machine Co., Seneca Falls, N. Y.
Circle Inform-A-Gram No. A74.

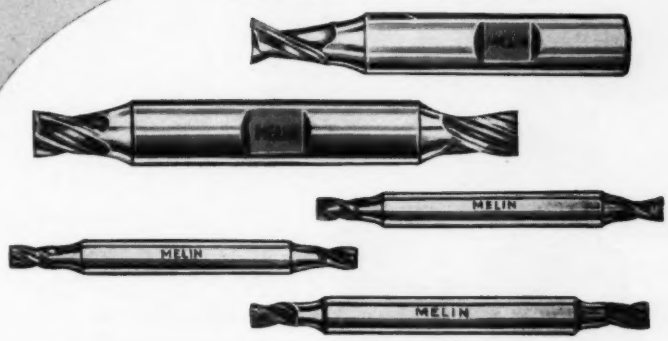


MELIN

STUB LENGTH END MILLS
with flutes shorter than regular

Offer GREATER STRENGTH*...

TWO, THREE AND FOUR FLUTE



...★ *Plus an Exclusive*... In addition to manufacturing a *complete* line of End Mills, the Melin Tool Company makes several standard *Stub Length Mills* exclusive of other tool manufacturers.

The new Melin Tool Catalog No. 54-C lists the specifications on these *all inclusive* Stub Length Tools...and...they offer greater strength and less breakage. Write for your catalog . . . today.

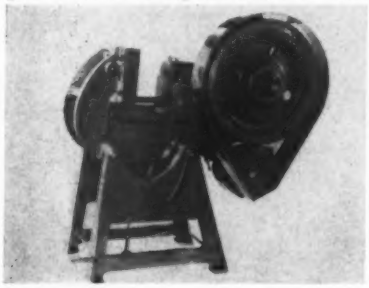
Representatives in Principal Cities

MELIN TOOL COMPANY, INC.

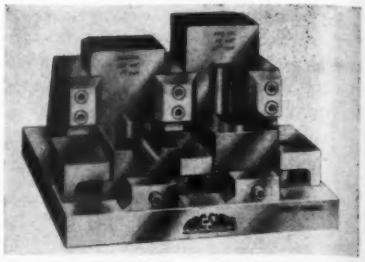
3371 West 140th Street
Cleveland 11, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 149

Eject Light Weight Parts properly with adapting the Press-Rite OBI press to a horizontal position. The press can be easily converted at the factory to a horizontal position for positive downward ejection of all parts, regardless of the lightness of the metal. Sales Service Machine Tool Co., 2363 University Ave., St. Paul, Minn., or —
Circle Inform-A-Gram No. A75.

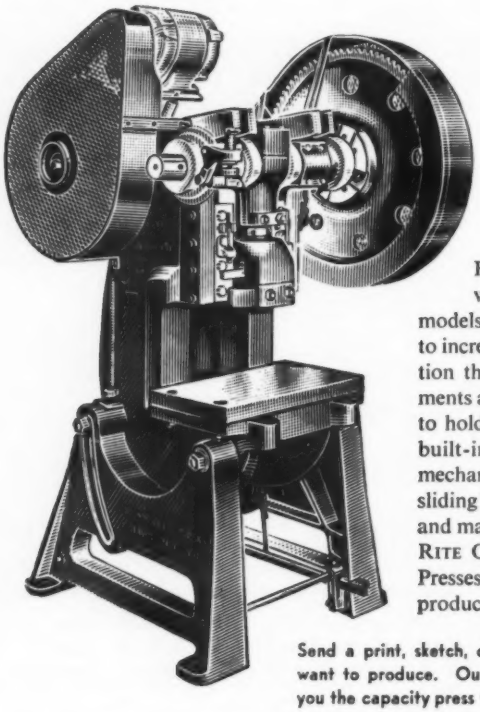


For Induction Welding or Brazing use the Arc-Snug which provides snug fittings, true contour notching, with clean edges that fit. It has two sets of punches and dies so that both the first and second cuts of the desired notch are made with a single press downstroke. Vogel Tool and Die Corp., 1825 N. 32nd Ave., Melrose Park, Ill., or —
Circle Inform-A-Gram No. A76.



PRESS-RITE
O. B. I.
POWER PRESSES

2 TON TO 85 TON



No. 3½—37 Ton Backgeared Press illustrated includes PRESS-RITE features that increase production and die life, cut maintenance costs.

High tensile, semi-steel frames, with built-in tie rods on larger models, hold deflection to a minimum to increase die life. Precision construction throughout with simple adjustments at wearing points makes it easy to hold accuracy. Greater die space, built-in non-repeat single stroke mechanism, automatic brake, 4 point sliding key clutch, efficient lubrication and many other features make PRESS-RITE Open Back Inclinable Power Presses high production presses that produce More Profits.

Send a print, sketch, description or sample of part you want to produce. Our engineering department will tell you the capacity press they recommend for the operation.

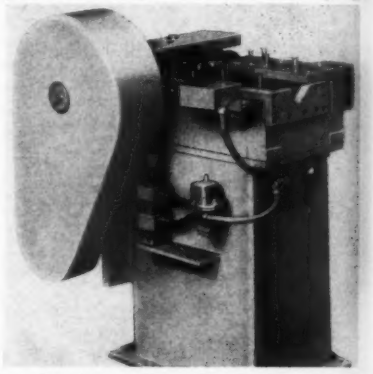
Ask your PRESS-RITE dealer or write for latest catalogue.

PRESS-RITE Division of
SALES SERVICE MACHINE TOOL CO.
2351 University Avenue
ST. PAUL W-14, MINNESOTA

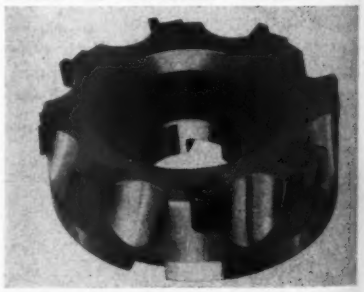
PRESS-RITE
O. B. I.
POWER PRESSES

CIRCLE INFORM-A-GRAM KEY NO. 150

Rugged Construction is a feature of the double tube flaring machine. Models A-2 and B-2 consist of two basic mechanisms: a motor-driven mechanical press, and a mechanical punch-shifting and tube-clamping mechanism. Capacity is ½" OD x 0.035 steel tubing and up to ⅝" OD for copper, brass, or aluminum tubing. Automation Associates, Inc., 1444 E. 11 Mile Rd., Madison Heights, Mich., or — **Circle No. A77.**



Depths of Cut up to ½" with ample chip clearance is possible with a huge chip gullet in front of the blades of the Model Z cutters. Accuracy of the cutter body is protected in accidents because the wedge, located behind the blades, takes the brunt of any smashup. Thus, only the inexpensive wedges need be replaced. Futurmill, Inc., 6360 Highland Rd., Pontiac, Mich., or—**Circle Inform-A-Gram No. A78.**



economically priced press room equipment

DURANT Ram Scrap Choppers

Operated by press ram, independent of the die. Tool steel blades. Easily installed in any position only two bolts necessary.

Model	Max. Stock Width	Max. Stock Thick.	Price
M 1	3"	.062	69.
M 2	6"	.062	95.
M 3	10"	.100	165.
M 4	12"	.100	195.
M 5	16"	.100	250.

WRITE FOR NEW FREE CATALOG

DURANT Tool Supply Co.

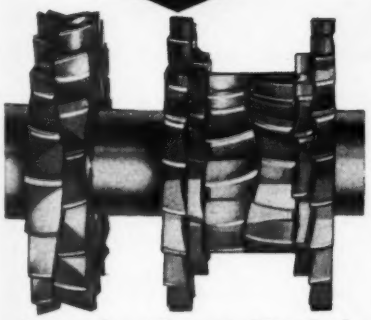
PROVIDENCE 3, RHODE ISLAND

CIRCLE INFORM-A-GRAM KEY NO. 1511

ABER

Curved Tooth

MULTIPLE CUTTERS



By using the wide range of Standard ABER CUTTERS for gang milling . . . fast accurate cuts on any number of surfaces simultaneously.

ABER Engineering service will design and make the unit exactly suited to your job . . . send blueprints and specify material to be cut.

ABER *Curved Tooth* PLUS FEATURES

1. Longer production runs
2. More accurate control of limits and finish
3. Elimination of chatter
4. Faster heat dissipation
5. Shearing action

FREE DATA — 24 page catalog on milling with ABER Cutters.

ABER ENGINEERING WORKS

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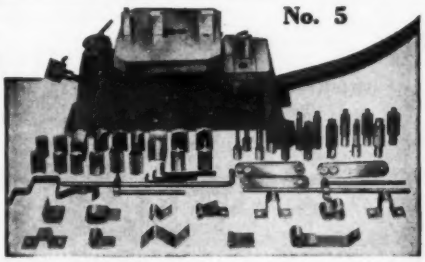
CIRCLE INFORM-A-GRAM KEY NO. 1512



No. 5

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J. A. RICHARDS COMPANY

Multiform

BENDER-CUTTER

CUTS, BENDS, PUNCHES

Available in hand, air or hydraulic models. The MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to ⅛" x 1½" as illustrated. Punching dies available. Other models up to ½" x 8" hydraulic operated. Ideal for steel rule die forming.

ALSO AIR OPERATED MODELS

KALAMAZOO, MICH.

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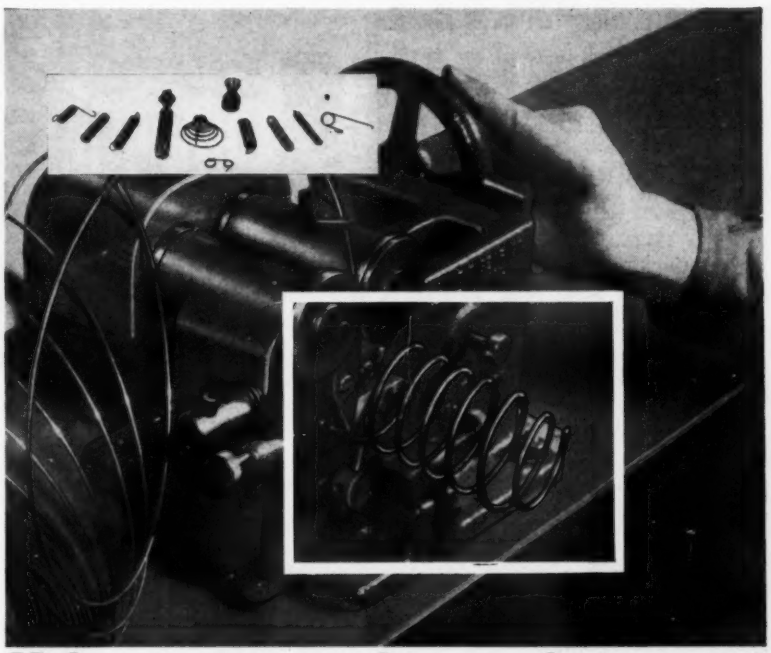


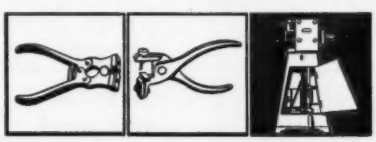
Make any type spring . . . fast, exact!

WITHOUT USE OF ARBORS

For a replacement or experimental spring, any shape, diameter or pitch from flat or round wire sizes .005" to .125", you can produce it in a matter of seconds with Perkins Precision Spring Coiler. You eliminate arbors, yet turn out precision springs — torsion, compression, extension, tapered, or special springs, coiled either left or right hand, in any desired length, any diameter from 3/32" to 12" and larger, with or without initial tension, and with open or closed ends. Eliminate expensive special orders and costly production delays! Make your own springs to exact specifications as replacements or experimental work. Make them fast, right in your own shop!

PERKINS MACHINE AND GEAR CO.

Special Machinery Division, West Springfield, Mass.



Starret adjustable jaw cut nippers (left) and Gardener Hook-Kon spring looping tool (center) — handy, precision, time-saving accessories for spring coiling. Perkins Spring Coiler available as bench model or power model shown here, (right) for tool shop or continuous runs.

Perkins Machine and Gear Co.
Special Machinery Division, Dept. B1
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Please send information and prices on Perkins Spring Coiler.
Hand Model ☐ Power Model ☐

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CIRCLE INFORM-A-GRAM KEY NO. 1514

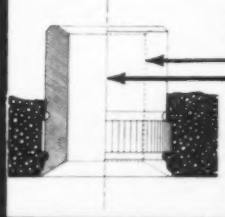
NOW!
FLAR-A-LOCK®
PRESENTS A
NEW
LOW COST
DRILL
BUSHING
FOR **PLASTIC TOOLING**

● CUT TOOLING COSTS WITH AN ECONOMICAL DRILL BUSHING THAT CAN BE PRESSED AND LOCKED IN THE TOOL AFTER LAMINATION, OR INSTALLED BY CONVENTIONAL TOOLING METHODS.

PERMITS CLOSE HOLE PATTERN

● NO RIVETS REQUIRED—SIMPLY INSTALLED WITH EITHER A HAMMER AND HAND FLARING TOOL OR WITH AN ARBOR PRESS AND STATIONARY FLARING TOOL.

QUICKLY INSTALLED!


ALL WEARING SURFACES ARE ACCURATELY CASE HARDENED.
BUSHING CENTERLINE IS HELD CONCENTRIC WITH THE PILOT HOLE IN TEMPLATE BY THE UNIFORM RADIAL DISPLACEMENT OF THE FLARE

EASILY REMOVED!

● ALSO AVAILABLE FOR 1/16" AND 1/8" SHEET STEEL OR ALUMINUM AND 1/4" MASONITE BOARD.

NO SPECIAL SKILL!

WRITE TODAY FOR CATALOG #1028

TECHNO-PRODUCTS CORP.
P.O. BOX 308, SWARTHMORE, PENNA.

CIRCLE INFORM-A-GRAM KEY NO. 1521

When You Need Turning Space for **"CLOSE-QUARTERS"** *Tapping*

WALTON TAP EXTENSIONS
QUICKLY PROVIDE NEEDED LENGTH

With these specialized tools in your crib you are prepared to meet a tapping delay that can increase costs unnecessarily.

In sets of two 5" extensions for use singly or in combination. Fit all standard hand taps (4-flute, 3-flute, and 2-flute styles) from No. 10 (3/16") to 1" inclusive. Special alloy, heat-treated steel.

Stock Walton Tap Extensions as insurance against a "close-quarters" tapping problem in your shop.

Write for DATA FOLDER No. 38 Contains specifications and prices of all Walton time-and-labor saving tools.

SINCE 1908 WALTON TOOLS HARTFORD, CONN
THE WALTON COMPANY HARTFORD 10 CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 1522

√√√Check these *3 Comet* 'TIPS'

*WHICH TWIN USES *Comet*® BORING TOOLS?

(H. S. S. and Carbide) for Holes from 1/16" upward

*THIS ONE

STANDARD AND SPECIAL BORING, FACING & INTERNAL THREADING TOOLS. *Write for Data*

Bore Small Holes? Contact COMET

Comet® LOW COST High Speed Steel **STEP DRILLS** are the answer!

Made to Your Own Specifications

PROMPT SERVICE

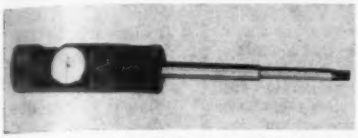
Write for Complete Data

COMET Tool Co.

738-T Broadway • New York 3, N. Y.

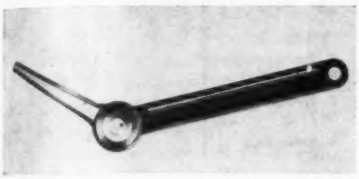
CIRCLE INFORM-A-GRAM KEY NO. 1523

Check Hole Location and concentricity without turning either your hand or the gage handle, yet read the indicator directly. The Con-Chek hole relation gage comes in a



full range of models, from 0.200" dia to 1.750" dia. Mayes Tool Co., 26514 W. Seven Mile Rd., Detroit 19, or —
Circle Inform-A-Gram No. A79.

Remove Tools from Machines in a singlehanded operation with a tool ejector and eliminate the hazards incurred with the use of a conventional hammer and drift. The cam-



action ejector eases the tool out of the spindle without any blows or jerks. Tapmatic Corp., 845 W. 16th St., Costa Mesa, Calif., or —
Circle Inform-A-Gram No. A80.

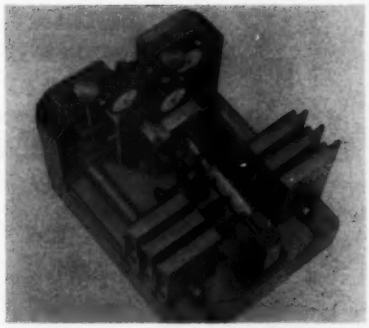
Increase Blade Life and cutting speed with power hack saw blades. A feature of these Guillotine Du-Weld Pro-Set blades is a progressive tooth setting in which tooth and gullet capacities are identical in size,

but with the amount of set increasing in infinite degrees from starting to finishing ends of the blade. The E. H. Wachs Co., 1525 N. Dayton St., Chicago 22, or —
Circle Inform-A-Gram No. A81.

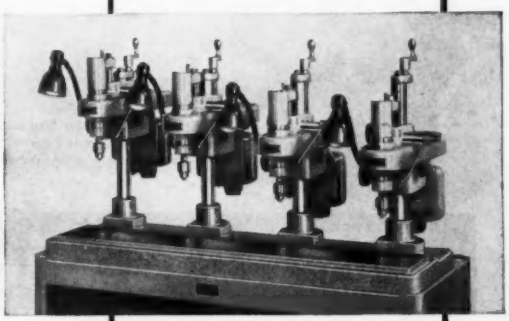
Carboloy Toolholders feature a one-piece chipbreaker-clamp that functions automatically. The Lift-O-Matic includes a clamp screw accessible from top or bottom and a

clamp color coding for quick identification. The chipbreaker-clamp has a carbide coat fused to the chipbreaker surface to eliminate braze failure. General Electric Co., Detroit 32, or —
Circle Inform-A-Gram No. A82.

A Universal Precision Gage features airfoil template holders that are adjustably mounted on hardened and ground ways on the base of the unit. The template holders are positioned by interchangeable master gage bars. This design enables blades of any length to be checked while consistently maintaining template alignment accuracy of 0.0002". Shepard & Young Tool Co., 15150 Telegraph Rd., Detroit 39, or —
Circle Inform-A-Gram No. A83.

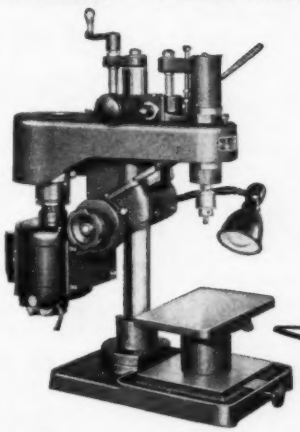


HAMILTON
SUPER SENSITIVE, SMALL-HOLE
PRECISION
REPEAT
PRECISION
DRILLING MACHINES



"for the finest work you do"

SINGLE OR MULTIPLE SPINDLES • VARIOUS CAPACITIES • WIDE RANGE OF CLEARANCES • VARIABLE SPINDLE SPEEDS • COMPANION TAPPING MACHINES



Designed and built to *master* the heart-breaking jobs which are so often attempted on drilling machines of "standard" accuracy.

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will want full information!
WE WILL SUPPLY IT
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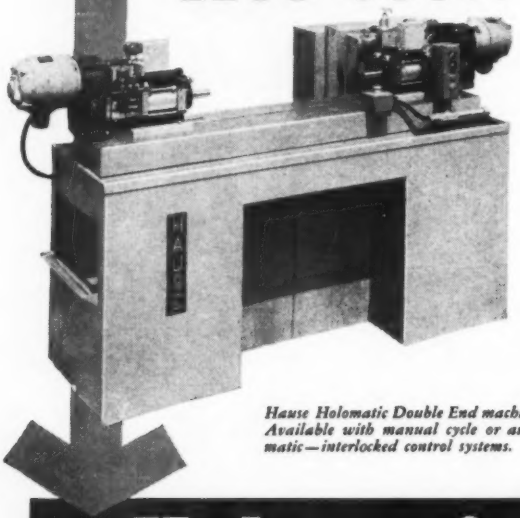
IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

2467

CIRCLE INFORM-A-GRAM KEY NO. 153

DRILL-TAP
THREAD-FACE
REAM . . .

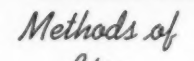
FASTER at LESS COST!



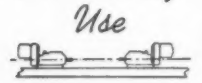
Hause Holomatic Double End machine. Available with manual cycle or automatic—interlocked control systems.

with a **Holomatic**

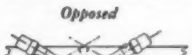
Methods of Use



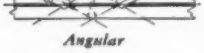
Opposed



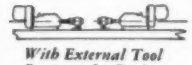
Angular



With External Tool Supports for Boring



Off—Set



With Multiple Spindle Heads

With Extra Units Mounted Overhead at 90 Degrees

• Hause Holomatic Double End machines are designed specifically to perform *two or more* drilling, tapping, threading, reaming, thread rolling, chamfering, spot facing—or similar operations *at one time.*

Holomatic units use factory air supplies for thrust power and a self-contained hydraulic system provides positive, infinitely adjustable control of the rapid travel and feed movements of the quill.

A Holomatic Double End machine efficiently handles parts up to 35" long by 18" in diameter. Capable of drilling ⅝" in mild steel, tapping ¾" —16 and cycling speeds up to 3600 full length strokes per minute. Easy to set up using standard air clamps, index tables and other part locators.

A Holomatic Double End machine in your plant will quickly pay for itself—even on low quantity production work. Investigate the many advantages of the Holomatic system—now!

• *Write today for complete information plus an actual obligation-free Holomatic demonstration in your plant.*

Hause

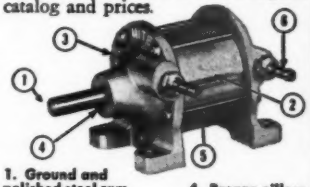
MACHINES, INC.
MONTPELIER, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1541

AIR-MITE AIR CYLINDERS

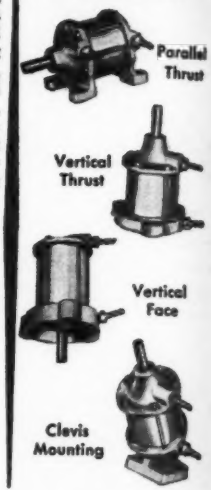
Low Cost Compact Powerful Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



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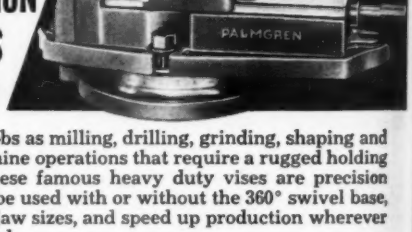

On such jobs as milling, drilling, grinding, shaping and other machine operations that require a rugged holding device. These famous heavy duty vises are precision built, can be used with or without the 360° swivel base, come in 2 jaw sizes, and speed up production wherever they're used.

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with swivel base, No. 40B, **$79.95**

NO. 60 . . . 6" jaw, without base, **$89.95**
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USED IN ALL INDUSTRIES . . . EVERYWHERE

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PUBLICATION PREVIEWS

CATALOGS • BULLETINS • SPECIFICATIONS

Circle Inform-A-Gram key number on postage-free Reader Service Card for your request.

Sel-Loc Spring Pins and cost saving applications in a variety of product assemblies are illustrated in a 4-page folder. Applications shown include use in conveyors and gear assemblies. Information on sizes, materials, finish, hardness, strength, and other specifications are included in tables and drawings. Copies of this bulletin are issued by Standard Pressed Steel Co., Box 600, Jenkintown, Pa., or —
Circle Inform-A-Gram No. B1.

A Wheel Approach Control Bulletin has been issued by the Landis Tool Co. The 4-page bulletin shows how this control speeds the grinding cycle on new Landis cylindrical grinders when work with large variations in stock have to be ground. Copies may be obtained from Landis Tool Co., Waynesboro, Pa., or —
Circle Inform-A-Gram No. B2.

Optical Comparators are presented in a comprehensive catalog which explains what they are, what they do, and how they work. Explanations of how different units are used, and dimensions of the different charts used with these units are given. Catalog 5700 is supplied by Jones & Lamson, Springfield, Vt., or
Circle Inform-A-Gram No. B3.

Modernization and Conversion Assemblies for older, obsolete, or worn straight side and gap frame presses are described in a bulletin. Discussed are 18 examples of how factory-engineered, plant-installed assembly kits add to the older press more working strokes, power slide adjustments, roller bearings, etc. Copies of Bulletin 45 are published by E. W. Bliss Co., 1375 Raff Rd. S.W., Canton, Ohio, or —
Circle Inform-A-Gram No. B4.

A Versatile, Rotary Motion Power Cylinder features positive seal and is immune to abrasives and corrosion. Outlined in a bulletin, this cylinder operates equally well mounted in any position and can be worked through gear train, chain, or cam action with a change of the output shaft member. The bulletin is released by Michigan Div'n, Thompson Products, Inc., 34201 Van Dyke Ave., Warren, Mich., or —
Circle Inform-A-Gram No. B5.

Hydraulic Presses are offered in a bulletin which gives specifications of these products. Tonnages range from 25 to 150 tons and standard equipment included on each model is given. Write to Lempco Industrial, Inc., 5490 Dunham Rd., Bedford, Ohio, or —
Circle Inform-A-Gram No. B6.

A Cutter and Accessories Catalog has been published by Brown & Sharpe Mfg. Co., Providence. This 96-page illustrated catalog covers the entire line of metal cutting tools, as well as arbors, adapters, collets, and vises. Write to the company for your copy of Catalog 37C.
Circle Inform-A-Gram No. B7.

5603

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NEW *Designs*

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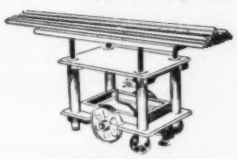
The Handy HAMILTON Portable, Elevating Table



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NEW provision for raising and lowering overhanging loads!

NEW convenience in maneuvering! Six wheel models roll easier . . . turn shorter.

NEW overhanging conveyor tops!

More stamina, more versatile performance than ever before

NEW FREE LITERATURE illustrates and describes all! Write for Bulletin P-5603. Address, The Hamilton Tool Company, 832 South Ninth Street, Hamilton, Ohio.

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Attach this page to your letterhead
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CONICAL TOOL CO. 3890 Buchanan S.W.
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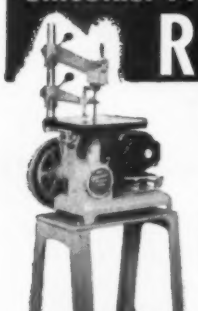
CIRCLE INFORM-A-GRAM KEY NO. 1561

Smoother Production! Higher Output! Lower Costs!

RICE-MILWAUKEE



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This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

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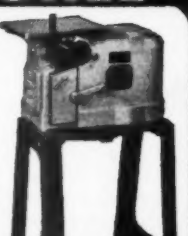
. . . for high speed Precision Grinding of Curved and Irregular Contours.

Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.



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RICE PUMP & MACHINE COMPANY

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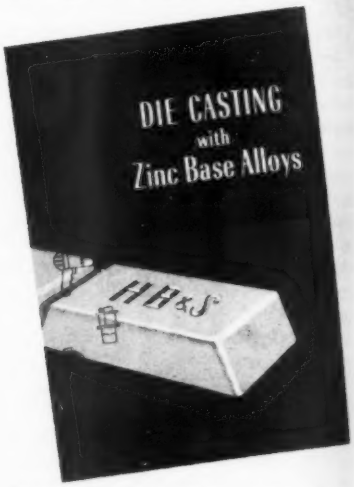
CIRCLE INFORM-A-GRAM KEY NO. 1562

"Die Casting with Zinc Base Alloys" has been revised and contains data on factors which influence the production of sound zinc alloy die castings with good surface finish.

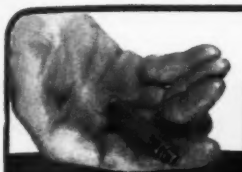


These include alloy composition, temperatures, metal injection pressures, care of dies and machines, etc. This bulletin is made available by Henning Bros. & Smith, Inc., 91-127 Scott Ave., Brooklyn 37, or —— **Circle Inform-A-Gram No. B8.**

Increase Capacity up to 30% or more with an electronic feed control on grinders, mixers, roller mills, or any machinery where speed of feeding operation depends on its motor. This and other advantages and applications are contained in a bulletin. Direct requests for copies of the bulletin on electronic feed controls to Load Star Corp., 1474 S. Vandeventer, St. Louis 10, or — **Circle Inform-A-Gram No. B9.**

High Speed, Continuous Drawing of Non-Ferrous Wire in intermediate sizes is possible with the No. 2 intermediate, upright cone type wire drawing machine described in a bulletin. It features the machine's oscillating multiple die holders, drawing cones, drives, etc. Circular 945-W is being distributed by The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., or — **Circle Inform-A-Gram No. B10.**

A 2000-lb Capacity Fork Truck designed for those applications where quick handling and tiering of loads is necessary is described in a brochure. Center control and sit-down operation are features of the Elpar Model F-26T2. Direct requests for copies to Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, or—**Circle Inform-A-Gram No. B11.**



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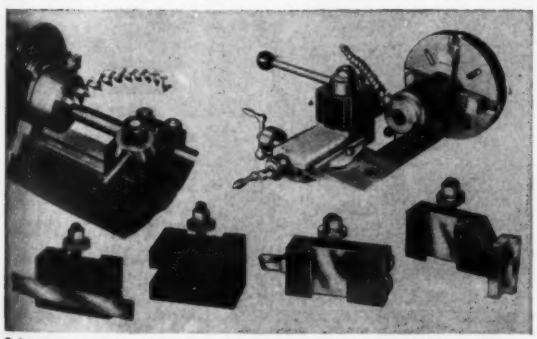

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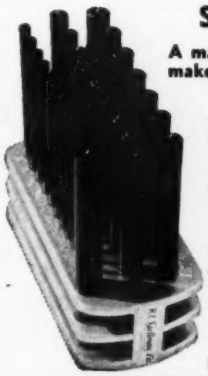

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Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—sizes 3/32" to ½" by 1/64" plus hand 17/32" size—length 4⅞". PRICE only $17.90

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WITH KNU-VISE CLAMPS

It's a plastic dome skylight . . . produced by "blowing" heat softened plastic sheets under 30 lbs. of air pressure. To hold the hot plastic during the "blowing" process clamping had to be safe, positive, dependable. To handle the various sizes and shapes of skylights produced clamping had to be versatile. And to speed production, clamping had to be fast to grip, quick to release. Knu-Vise clamps provided the answer to all these requirements . . . can answer your holding problems, too. For complete information or engineering assistance write Lapeer today.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

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Machine downtime, quality control problems, shortened machine life and loss of precision—*all* can be caused by excessive vibration. To avoid these costly hazards, machines should be *set* level . . . *kept* level . . . and *re*-leveled periodically. *How?* Equip your machines with EMPCO Leveling Jacks! EMPCO Jacks facilitate machine installation and set-ups . . . assure smooth, positive adjustment . . . provide dependable support for machine tools, large surface plates, automation lines, tool room and production equipment of all types.

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VI-SORB Mounting Pads provide extra protection—reduce the transmission of internal machine noises throughout the building structure and check transmitted vibrations from one machine to another. They retard machine creepage and frequently eliminate the need for anchor bolts. VI-SORB Pads do not breakdown under repeated impact loads or deteriorate with age. They resist oils, greases, acids. Available in thicknesses to meet specific conditions and cut to fit EMPCO Jacks. Set your machines level, keep them level, *freer of vibration*, with EMPCO Jacks and VI-SORB Mounting Pads!

EMPCO LEVELING JACKS

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Available in Six Styles—25 Models
Capacity-Rated to 20 Tons!

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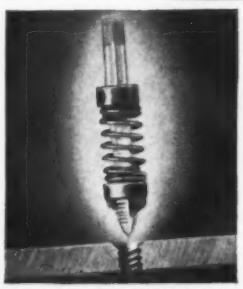
TAP AND DEBURR IN ONE OPERATION

Slip a BURR-BIT onto any make tap and holes are automatically deburred while they are being tapped. Save money, time and labor by COMBINING TWO OPERATIONS INTO ONE.

AS TAP IS WITHDRAWN, BURR BIT DEBURRS, LEAVING CLEAN CHAMFER



First thread which creates burr, has been AUTOMATICALLY, QUICKLY AND PRECISELY REMOVED, leaving perfectly smooth finish for easy screw insertion.

Precisely engineered of finest quality high speed tool steel for use on almost every material. The BURR-BIT is used by many large and small manufacturers throughout the country.

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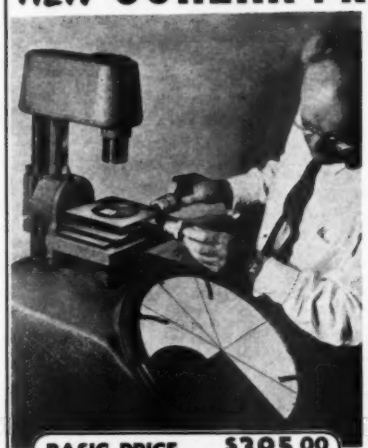

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Precision Grinding and Boring Spindles are illustrated and described in a brochure. Spindles for use as original equipment for machinery builders or as replacement

spindles to improve the performance of grinders and boring machines in use are highlighted. For a copy of Bulletin 25477 write to Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, or —
Circle Inform-A-Gram No. B12.

Ivaro and Airvan Grades of ground flat stock are detailed in a bulletin. Thicknesses, widths, and data on typical analysis, hardening, and quenching and tempering of the two steels are included. Write to Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, for copies of Bulletin GFSI-57, or — **Circle No. B13.**

OBI Mechanical Gap Presses are detailed in a bulletin released by A. B. Farquhar Div'n, The Oliver Corp., York, Pa. The bulletin gives a general description of the four capacities of presses in addition to the features and specifications. Diagrams are also included. Copies of Bulletin M-100 may be obtained from the company, or—**Circle Inform-A-Gram No. B14.**

Pneumatic Air Motored Agitators are highlighted in a bulletin which gives applications and specifications. Each type of agitator is pictured and detailed diagrams and explanations are included. Copies of Catalog 30 are supplied by Eclipse Air Brush Co., 390 Park Ave., Newark 7, N. J., or—**Circle Inform-A-Gram No. B15.**

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Circle Inform-A-Gram No. B16.

A 16" Precision Drilling Machine is highlighted in a bulletin from Electro-Mechano Co., 261 E. Erie St., Milwaukee. Minimum runout, table square to spindle, and ⅝" capacity are some of the features described in the publication. A comparison chart, operations, and illustrations are also included. Copies of this bulletin are available from the company.
Circle Inform-A-Gram No. B17.

Produce Electrical and Electronic Circuits accurately, quickly, and at low cost with metal-clad laminated plastics. Outlined in a bulletin the six most widely used grades are described and specifications are included. Detailed tables give strengths, properties, and dimensions of the laminates. Copies of the bulletin are available from Synthane Corp., Oaks, Pa., or —
Circle Inform-A-Gram No. B18.

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STANDARD MODEL—A precise, versatile Hand Miller with Rise and Fall spindle. Table size 6½" x 21".

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THESE 40-TON PRESSES take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are *very moderately priced.*

Significant savings may result if you let our engineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

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High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".

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Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

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High quality, low cost instrument with range up to 0.100". Reading to 0.001", easy interpolation to 0.0002".

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The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.
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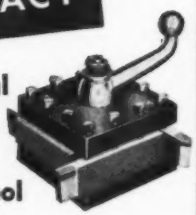

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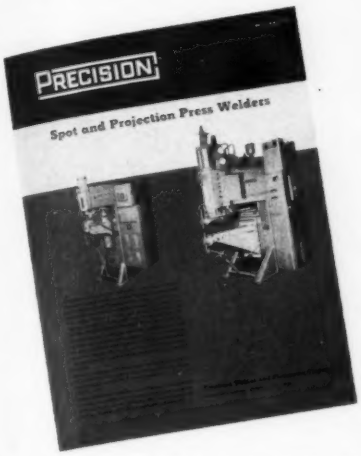
CIRCLE INFORM-A-GRAM KEY NO. 1604

Precision Spot and Projection Press Welders are fully described and illustrated in a bulletin. Specifications are listed for the entire line which includes resistance welders



from 30 to 600 KVA, 1275 to 18,000 lbs electrode forces, 12" to 30" throat depth. Bulletin P-101 is published by The Precision Welder and Flexopress Corp., 3520 Ibsen Ave., Cincinnati 9, or —
Circle Inform-A-Gram No. B19.

20000 Precision Instrument Components are listed in a handy pocket size booklet. Detailed drawings and charts of specifications are given for spur gears, miter and bevel gears, anti-backlash gear assemblies, etc. Supplemental Catalog 13 is compiled by PIC Design Corp., Subsidiary of Benrus Watch Co., Inc., 477 Atlantic Ave., E. Rockaway, N. Y., or —
Circle Inform-A-Gram No. B20.

Adjustable Broaches are featured in a bulletin which illustrates and describes the products. An explanation of operation and a chart of specifications and engineering data is included. Sets of the products are available in different combinations. Copies of Bulletin 19 are available from The East Shore Machine Products Co., 50 E. 201st St., Cleveland 23, or —
Circle Inform-A-Gram No. B21.

Use Depressed Center Wheels on portable grinders and coated disc sanders. A bulletin lists uses, applications, and features of wheels. A chart containing size, speed, and grade is also given. For your copy of Bulletin PG-335 write to Cincinnati Milling Products Div'n, Cincinnati Milling and Grinding Machines, Inc., Cincinnati 9, or —
Circle Inform-A-Gram No. B22.

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Descriptive Bulletins, Prices, and Dimensional Data Sheet No. 7-A upon request. Ask for prices on salvaging worn-out plug and ring gages.

ECONOMY TOOL & MACHINE CO.

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CIRCLE INFORM-A-GRAM KEY NO. 1612

"6 Special Ways to Air Gage For Lower Costs, Higher Production" is the title of a brochure which is offered by Taft-Peirce Mfg. Co., Woonsocket, R. I. In one application the CompAIRamatic checks 4 dimensions and 5 locations on 13-station traverse machine. Air gaging benefits are explained. Copies of the bulletin can be obtained from the company, or —
Circle Inform-A-Gram No. B23.

Automatic Gear Grinding Machines for gears, spline shafts, and specially contoured parts are highlighted in a catalog. Special features are pictured and described and examples of unusual grinding problems solved by these machines are included. Write to The Gear Grinding Machine Co., 3901 Christopher, Detroit 11, for a copy of "Automatic Gear Grinding Machines," or —
Circle Inform-A-Gram No. B24.

Speed and Convenience of Indexing Trunnions in drilling, tapping, and counterboring of a typical machine housing is shown in a bulletin. Complete specifications are listed on

all trunnion models as well as on the adaptors. Write to Johnson & Bassett, Inc., 110 Foster St., Worcester, Mass., for Bulletin 1057, or —
Circle Inform-A-Gram No. B25.

Set Up Welding Work with the Twinner magnetic clamps described in a bulletin. They can be used singly or in groups either for setting up on the welding table or for holding workpieces in position. Direct requests to Aronson Machine Co., Arcade, N. Y., for copies of the bulletin. **Circle Inform-A-Gram No. B26.**

Reproduction Materials for engineering, drafting, and print making are outlined in a brochure. Films, papers, and chemicals are discussed. A helpful selection chart is also included. Copies of "Kodagraph Reproduction Materials" are available from Eastman Kodak Co., 343 State St., Rochester 4, N. Y., or —
Circle Inform-A-Gram No. B27.

Aluminum Tooling Plate and Barstock is featured in a bulletin which gives information about how the products are made. Included in the specification data given are sizes, surface, flatness, and physical qualities. Write to Red Seal Metals Co., 10035 Burtis St., South Gage, Calif., for your copy of this bulletin, or —
Circle Inform-A-Gram No. B28.

37 Different Types of Standard Fasteners are illustrated in a brochure. Data pertaining to sizes carried in stock, threads, head and point styles, and grades of stainless steel is included. Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, L. I., N. Y., supplies copies of the bulletin, or —
Circle Inform-A-Gram No. B29.

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Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13". . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

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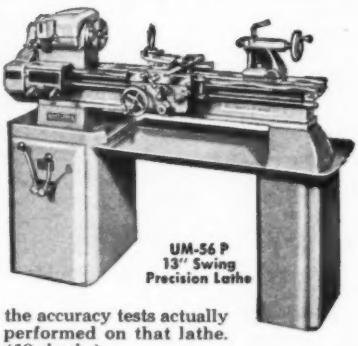
All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).


UM-56 P
13" Swing
Precision Lathe

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

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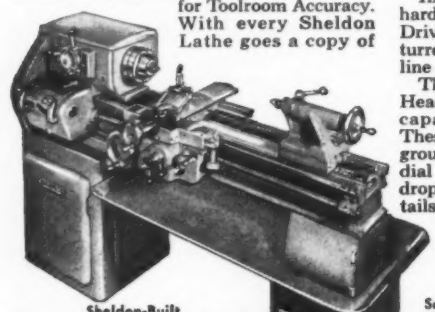
Sheldon-Built
Sebastian 13" and 15" Geared Head
Precision Lathes

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

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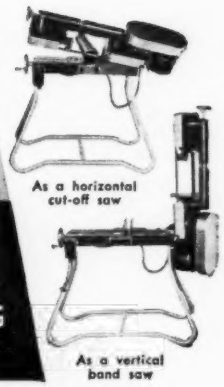
THE VERSATILE **WELLS 49A** METAL CUTTING BAND SAW



Use the Wells 49A in the shop, or take it to the "job-site"—you'll find it an efficient tool—a time and money saver on a wide variety of metal cutting jobs.

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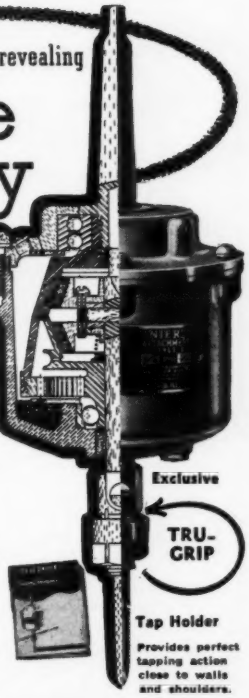

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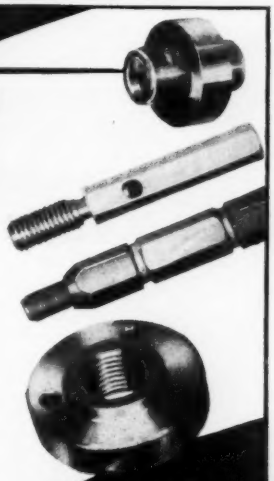

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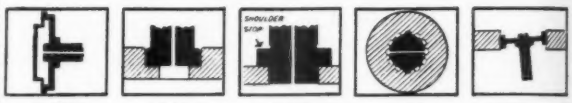

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Magna-tip® MAGNETIC SCREW DRIVING ACCESSORIES

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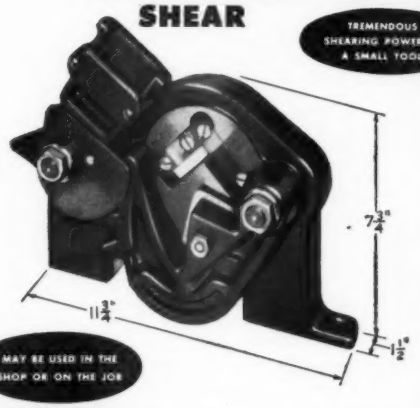

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Eliminate Drilling, changing punches and dies, and hand cutting with the Di-Acro turret punch press described in a brochure. Advantages and specifications of this machine are given along with discussions of different punches and dies available. Copies of this bulletin are made available by O'Neil-Irwin Mfg. Co., Lake City, Minn., or —
Circle Inform-A-Gram No. B30.

A Carbon Dioxide Welding Process, dual shield, is the subject of a bulletin. This method increases production, uses inexpensive carbon dioxide gas, eliminates metal cleaning preparation, and saves space. Other advantages and specifications are included. Copies are published by National Cylinder Gas Co., 840 N. Michigan Ave., Chicago 11, or —
Circle Inform-A-Gram No. B31.

An Alloy Temperature Range Chart has been announced by Rolled Alloys, Inc., 4815 Bellevue Ave., Detroit 7. In addition to the temperature range of alloys, the chart indicates the usefulness as to carburizing and/or nitriding, reducing atmospheres and oxidation. Request copies of Bulletin 106 from the company, or
Circle Inform-A-Gram No. B32.

For Direct Reducer Mounting on the shaft of the driven machine, use shaft mounted worm gear speed reducers outlined in a bulletin. Detailed drawings show dimensions and operation and charts give horsepower, torque, and overhung load ratings. Get your copy of Catalog SM-57 from Winsmith, Inc., 75 Eaton St., Springville, N. Y., or —
Circle Inform-A-Gram No. B33.

Design and Use of Such Cold Headed Specialties as rivets, nails, screws, and other fasteners and small parts are outlined in a bulletin. Data includes cost and design advantages and manufacturing possibilities plus information on metals and finishes. Catalog 106 is prepared by John Hassall Inc., Westbury, L. I., N. Y., or —
Circle Inform-A-Gram No. B34.

Coreless Induction Melting Furnaces for ferrous and non-ferrous metals are offered in a publication which includes information about the principle, advantages, and applications of this method. Technical data of the furnaces are presented in chart form. Ajax Engineering Corp., Trenton, N. J., supplies copies of Bulletin R58, or —
Circle Inform-A-Gram No. B35.

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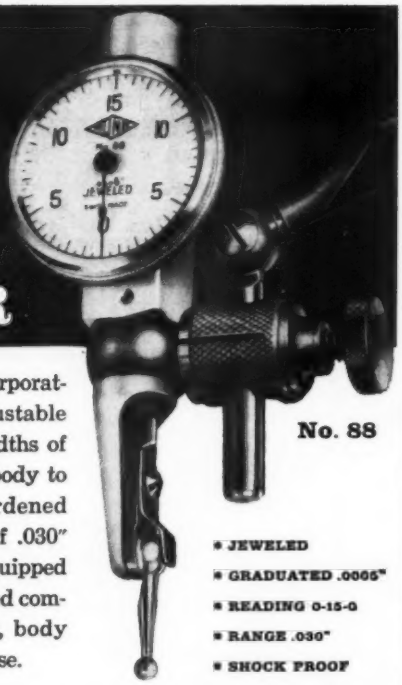

A fully reversible indicator incorporating a clear easy-to-read, adjustable dial, graduated in half thousandths of an inch, a switch lever on the body to reverse action and TWO hardened chrome plated contact points of .030" and .100" diameter that are equipped with a non-slip ratchet. Furnished complete with a universal shank, body clamp, and plush lined steel case.

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WITH OUR PORTABLE ELECTRIC RECIPROCATING TOOL

This handy tool will cut out many tedious hand filling and finishing operations — Increase Production — Produce Uniform Work.

Light in weight — Delivers 1/8" or 3/16" fixed stroke at 1000 strokes per minute — Operates on 110 volts AC or DC.

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CIRCLE INFORM-A-GRAM KEY NO. 1662

Monarch Precision SHAPLANE Radius Tools

Illustration shows convex cutter for 1/4" to 2 1/2" balls.

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Range 1/2" to 3" for concave Radii. Also heavy duty models for radii to 6" on planers, etc.

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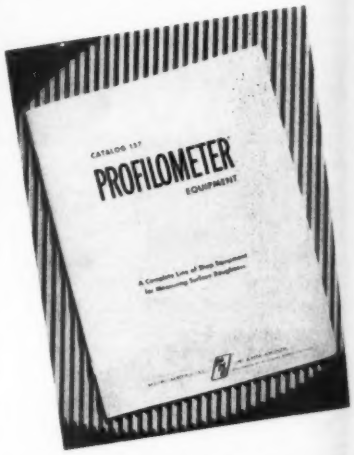
Surface Finish is the subject of a 14-page Profilometer catalog. Included in the catalog is portable equipment for straight-line mechanical tracing. Specifications and advantages for this product are given



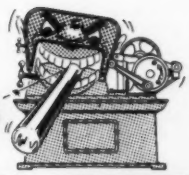
as well as for other equipment described in the bulletin. Catalog 157 on Profilometer equipment is published by Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich., or—**Circle Inform-A-Gram No. B36.**

Rolling Mills, gang slinters, wire flattening lines, roller levelers, and related metal processing machines are described in a 16-page brochure. The publication features photos depicting numerous applications, including several interesting field installations. Copies of Bulletin 1057 are supplied by Stanat Mfg. Co., Inc., 500 Shames Dr., Westbury, L. I., N. Y., or —
Circle Inform-A-Gram No. B37.

Greater Driver Vision and Safety, truck stability and maneuverability are features of an electric fork lift truck discussed in a bulletin. Built in 12,000 to 20,000 rated lifting capacities, the Elbolift is devoid of upright channels, chains, and sprockets. Write to Automation Transporation Co., 149 W. 87th St., Chicago 20 for Bulletin 6501A, or —
Circle Inform-A-Gram No. B38.

Produce Long, Straight, True Holes accurately in a single continuous operation with a deep hole driller. A circular describes the machine and gives other advantages and specifications. Direct requests for copies of Circular 608 to Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford 1, Conn., or —
Circle Inform-A-Gram No. B39.

New Bite for POWER HACK SAWS with



GUILLOTINE DuWeld PRO-SET

finishing teeth have heavier set

PRO-SET: progressively wider set teeth

entering teeth have lighter set

GUILLOTINE DuWELD® PRO-SET TRADE MARK

POWER BLADES

● Guillotine DuWeld Pro-Set Power Blades feature a completely new concept in sawing.

Teeth and gullet capacities are identical in size but the amount of set increases in infinite degrees from starting to finishing ends of the blade. Impact at start of stroke is reduced 50%.

Metal is gradually and smoothly displaced instead of being "hogged" out. Chip load per tooth is greatly reduced.

Progressive cutting action is constant regardless of size of work piece. Every tooth is a working tooth resulting in 33⅓% more cutting action.

The chips are the proof. The tightly curled chips, generated by DuWeld Pro-Set Blades, are extremely elongated triangles when examined under glass, showing the progressive tooth loading action.

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Describes the new simplified *Counted Turn* Method. Eliminates gimmicks and gadgets.

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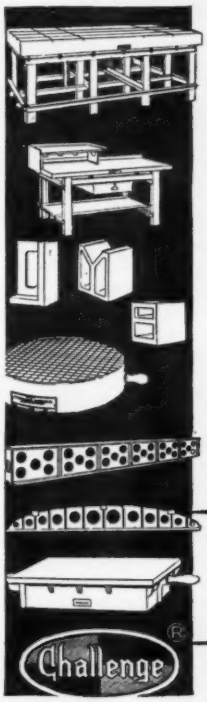
Phone Michigan 2-4650

CIRCLE INFORM-A-GRAM KEY NO. 1671

Here's everything for PRECISION LAYOUT INSPECTION and ASSEMBLY



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THE CHALLENGE MACHINERY COMPANY
SE-111 **Grand Haven, Michigan**

CIRCLE INFORM-A-GRAM KEY NO. 1673

INSERTED BLADE GENESEE FACING AND COUNTERBORING TOOLS

Interchangeable Pilots

Constant Chip Space Throughout Life of Blades

Standard Sizes 1¼ to 4 Standard with Straight or Morse Taper Shanks

H.S.S.—Carbide Tipped Blades. Save 25% or more over cost of Solid Tools

Consult our Engineering Department on your Inserted Blade Production Tool Problems.
WRITE FOR CATALOG 54P

GENESEE MANUFACTURING COMPANY
586 HOLLENBECK ST. • ROCHESTER 21, N. Y.
Adjustable Hollow Mills • Facing and Counterboring Tools • Special Production Tools • Since 1908

CIRCLE INFORM-A-GRAM KEY NO. 1672

ACCURACY .0002 T.I.R.

.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

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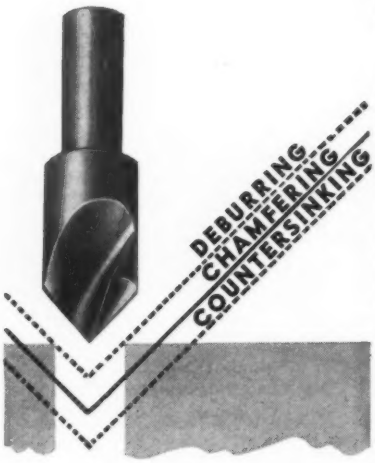
CIRCLE INFORM-A-GRAM KEY NO. 1674

FORD

H.S.S. UNIFLUTE COUNTERSINKS

. . . . free working smooth cutting for



You'll need fewer tools for these jobs because the FORD H.S.S. Uniflute Countersink is designed to handle all three of these operations — in any hole size from the end diameter to the major diameter. The simple single flute design with cam relief does it. Eliminates chatter and secondary burrs. Low in cost, too — and easily re-sharpened in your own shop. We tell you how. Also available in Carbide.

Rotary FORD Tools

WRITE FOR NEW FORD BULLETIN NO. 702

M. A. FORD Mfg. Co. Inc.

1551 Rockingham Road, Davenport, Iowa

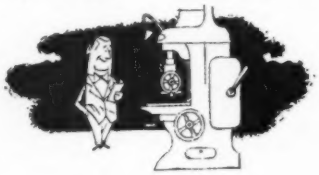
Precision Manufacturer of H.S.S. and Carbide Rotary Cutters Carbide End Mills • Special Tools

CIRCLE INFORM-A-GRAM KEY NO. 1681

ATTEND THE 1958 ASTE TOOL SHOW

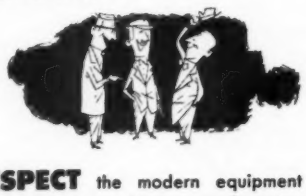
CONVENTION CENTER PHILADELPHIA MAY 1-8

SEE all the very latest advances and improvements in more than thirty major categories of industrial products.



ATTEND top-level conferences, conducted by recognized authorities on the newest production techniques and developments.

MEET and exchange ideas with management, engineering, production, sales people from the nation's leading industrial concerns.



INSPECT the modern equipment and up-to-the minute manufacturing methods being utilized in booming Delaware Valley plants.

AMERICAN SOCIETY OF TOOL ENGINEERS

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CIRCLE INFORM-A-GRAM KEY NO. 1682

HARDNESS TESTING

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•

THE SHORE INSTRUMENT & MFG. CO., Inc.

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Magnetic Base Indicator holders

Stainless holding rod set in ball socket
Precision adjustment like surface gage
Erick Magna Holder Model 200B Only $6.50
See your dealer or write for catalogue 755 on the most complete line of magnetic base units & access. mfg'd.
Powerful 50 lb. pull base

CULLEN MFG. CO., RACINE, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 1684

Seamless and Electric-Resistance Welded Steel Tubing are presented in a catalog which describes carbon and alloy seamless steel tubing in mechanical, aircraft mechanical, airframe quality, and pressure grades. Ohio Seamless Tube Div'n, Copperweld Steel Co., Shelby, Ohio, supplies copies of Bulletin CS-58, or — **Circle Inform-A-Gram No. B40.**

Industrial O-Rings are listed in a bulletin from Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22. The bulletin lists compounds formulated for a broad range of industrial purposes, together with hardness ratings, compatibility, and temperature ranges. Request copies of Bulletin OR-57 from the company, or — **Circle Inform-A-Gram No. B41.**

A Verti-Slide Vertical Four-Slide Machine is the subject of a bulletin published by The Torrington Mfg. Co., Torrington, Conn. Design details and component functions are given for the feed mechanism, cam and cam shafts, drive system and presses. Write to the company for a copy of the bulletin, or — **Circle Inform-A-Gram No. B42.**

An Optical Pickup Attachment for punching templates direct from drawings or printed master circuits is featured in a bulletin. It magnifies 4 times and is illuminated by a spot light adjustable from a pinpoint to 1" dia. The brochure is announced by Wales-Strippit Co., Houdaille Industries, Inc., Akron, N. Y., or — **Circle Inform-A-Gram No. B43.**

14" and 18" Wing Plain Cylindrical Grinding Machines are described in a bulletin. These machines are designed to carry workpieces up to 6500 lbs and are supplied in center lengths from 48" to 168". Specifications are accompanied by illustrations and diagrams. For copies of Bulletin D-57 write to Landis Tool Co., Waynesboro, Pa., or —
Circle Inform-A-Gram No. B44.

Special Size Gage Blocks are discussed in a brochure. Sizes range down to thicknesses of 0.004". Materials include special alloy gage block steel, chrome plated, tungsten carbide, cemented carbide, chrome carbide, and other alloys. Obtain your copy of the brochure from Jansson Gage Co., 13550 Auburn Ave., Detroit 23, or —
Circle Inform-A-Gram No. B45.

"What Do You Mean 'Specific' Taps?" tells how to get longer tap life and better performance when tapping different materials such as tough steels, cast iron, aluminum, zinc, brass, and plastics. Request copies of this bulletin from Detroit Tap & Tool Co., 8615 E. Eight Mile Rd., Warren, Mich., or —
Circle Inform-A-Gram No. B46.

Select a Variety of Tools from a catalog published by R and L Tools, 1825 Bristol St., Philadelphia 40. The 32-page catalog gives specifications and listings of turning tools, combination swing tools, roller backrests, carbide backrests, and tap and die holders. Write for your copy to the company, or —
Circle Inform-A-Gram No. B47.

Narrow Aisle Equipment is the subject of a bulletin which describes the outrigger type and reach fork electric tiering trucks. 13 special models for solving specific handling problems are also discussed. Get your copy of Bulletin 201 from The Raymond Corp., 292-160 Madison Ave., Greene, N. Y., or —
Circle Inform-A-Gram No. B48.

Vitrified and Resinoid Grinding Wheels are highlighted in a bulletin. Standard grinding wheel marking, standard wheel shape specifications, and other valuable engineering data are also included. Write to Simonds Worden White Co., 1101 Negley Pl., Dayton 7, Ohio, for a copy of the bulletin, or —
Circle Inform-A-Gram No. B49.

LOW COST
Standard Flush Pin Gages and Dial Indicator Gage Units

Choose the standard flush pin gages you need from over 650,000 variations catalogued by Rite-O. You'll get easier ordering (by composite number, no drawings), and real savings (Rite-O prices are lower).

The Rite-O dial indicator housing is a standard reusable unit, with a full ⅜-inch vertical adjustment of the indicator. It is available alone or as part of a full line of indicator depth gages (pictured).

WRITE TODAY! Get the Rite-O Flush Pin Catalog, with 16 pages of tables and prices. Enjoy first-quality gages that are lower in cost and easier to order.

RITE-O TOOL & GAGE COMPANY
321 West Ten Mile Road • Hazel Park, Michigan
Rite-O
Precision manufacturers of plain and threaded plug and ring gages, indicator depth gages, and special gages and fixtures

CIRCLE INFORM-A-GRAM KEY NO. 1691

MICRO-MINIATURES...
WE ARE
SPECIALISTS
MICRO MINIATURES®
In the mfg. of small end mills

STOCK SIZES 3/16" DOWN TO 1/32" BY 1/32"
Ground From Solid
— 3/16" SHANK — — 2 FLUTE —
— 1/8" — — 4 FLUTE —
— DOUBLE END — — BALL END —
— REGULAR LENGTH — — STUB LENGTH —
SPECIAL SIZES .1875" DOWN TO .020"
Distributors in principal cities
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CAMS ALL TYPES MADE TO YOUR SPECS

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EISLER ENGINEERING CO., INC.
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CIRCLE INFORM-A-GRAM KEY NO. 1693

JIG BORING
and
Large Precision Machining
Done to your specifications
We Have
22 Jig Borers
KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1694

MANUFACTURING MEMOS

New Division . . .

● The Sealol Corp. announces the organization of their Acra-Ment Instrument Division, established to manufacture and market precision indicating gages. The division is a result of the acquisition of the Myer Corporation's indicating gage line. The facilities of Sealol's Anchor Tool and Die Division will be utilized for the manufacture of these instruments.

Fourth Award . . .

● The National Safety Council recently presented Hanna Engineering Works with their fourth consecutive first place award in the Metals Section of the National Safety Contest. Hanna received its award for completing the contest year without a disabling accident, which represents 2,211,988 total man hours worked without a lost-time accident.

Group Awarded . . .

● Development of the diesel-electric locomotive was commemorated by the presentation of the 1957 Elmer A. Sperry Award to three early leaders in the development who were members of the Electro-Motive Division of General Motors Corp. This is the first time the honor has been conferred on a group rather than an individual.

New Lines . . .

● Brown & Sharpe Mfg. Co. will sell the Lipe-Rollway Corporation's automatic magazine loading bar feed for installation on Brown & Sharpe single spindle automatic and hand screw machines. The agreement permits B & S to install, service, and maintain the Lipe bar feed together with their screw machines.

● Lennox Tool & Machine Builders have expanded their operations to include two proprietary items — drilling machines and contour shears — through their purchase of the complete line of Baker Brothers Inc.

Two Honored . . .

● Recipients of the highest awards in the field of voluntary standards, two gold medals presented by the American Standards Association, have been announced. Royer E. Gay receives The Howard Coonley Medal for "great service in advancing the national economy through voluntary standards." The Standards Medal was presented to John Robert Townsend, special assistant to the Assistant Secretary of Defense for leadership in the actual development and application of standards.

Acquisition of Spinform, Inc. specialists in forming and spinning all types and gages of metals and alloys, by Pantex Mfg. Corp. was announced recently. The addition of Spinform, Inc., will complement the Pantex range of manufacturing facilities.

◆

Buhr Machine Tool Co. announces the purchase of The Sidney Machine Tool Co., manufacturers of heavy-duty precision metalworking lathes. Sidney will be operated as a wholly-owned subsidiary and will continue to manufacture Sidney thes and coil-winders.

◆

Two new metallurgical laboratories have been put into operation by Gardner-Denver Co. One will serve the plants located at the company's headquarters in Quincy, Ill., and the other is located at the Keller Tool Division in Grand Haven, Mich. These laboratories will help maintain and improve the quality of the products.

◆

General Mills, Inc. has announced formation of a Nuclear Equipment Department as a part of the company's Mechanical Division. This department will concentrate on the further development, design, and manufacture of remotely-controlled handling equipment for use in nuclear laboratories and reactor installations.

◆

The Brown Instruments Division of Minneapolis-Honeywell was awarded the 1956 Public Relations News' annual Achievement Award for "its pioneering campaign to allay fears of automation by giving business . . . the true facts about the economic and social benefits . . ." The company was one of ten to receive this award.

◆

Air Products, Inc. has purchased the assets of Kemsco, Inc. The company will continue to manufacture the Kemsco liquefied gas pump and will conduct research and development work on special low temperature equipment and processes.

◆

The Carpenter Steel Co., has taken over the Northeastern Steel Corp. which will be known as the Carpenter Steel of New England, Inc. The wholly-owned subsidiary will make electric furnace quality alloy and stainless steels.

— SAVE THIS AD FOR FUTURE REQUIREMENTS — DEALERS INQUIRIES INVITED —

NEW SIZES ADDED DAILY . . . IF NOT LISTED HEREIN — INQUIRE

WHY WAIT FOR SPECIAL

High Speed Steel Taps and Dies and Thread Plug Gages?

In Stock For Immediate Delivery

RIGHT HAND TAPS AND THREAD PLUG GAGES

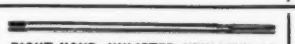
Size	Threads Per Inch
00	90-96
0	56-64-72
1	56
2	60-72
3	40-60-64
4	32-42-44-56-60-64-72-90
5	30-32-36-48-56-60-80
6	30-36-38-42-44-48-56-60-64
7	28-30-32-34-36-38-40
8	24-26-30-38-40-44-48-56-60-64-80
9	24-28-30-32-40
10	18-20-22-26-28-30-36-40-48-56-64
11	20-22-24-28-30
12	20-22-26-27-30-32-36-38-40-48-56
13	20-22-24-32
14	16-18-26-28-30-32
15	18-20-24-32
16	16-18-20-22-24-36
17	16-20
18	16-18-20-24
19	18-20
20	16-18-20-24-32
22	16
24	14-16-18-22-24
26	14-16
28	14-16
30	14-16
1/16	56-60-64-72
5/64	56-60-64-72
3/32	38-48-50-56-60-64
.107	52
7/64	36-40-42-44-48-50-56
1/8	30-32-36-40-48-56-60-80
.132	50
9/64	30-32-38-40
5/32	24-26-28-30-32-36-38-40
11/64	24-26-30-32-36-38-40
3/16	12-18-20-22-24-26-28-30-32-36-40-48-56-64-72
.198	24
13/64	24-28-30-32
7/32	20-22-24-26-27-28-30-32-36-38-40
.227	24
15/64	20-24-28-32-40
1/4	16-18-22-23-24-25-26-27-30-32-36-40-48-50-56-60
17/64	18-20-27-28
.268	36
.277	40
9/32	18-20-24-26-27-28-32-36-40
19/64	18-24
.300	28
5/16	12-14-16-20-22-26-27-28-30-32-36-40-48-50-56
21/64	16-20-24
11/32	16-18-20-22-24-26-27-32-40
23/64	16-24
.365	25
3/8	12-14-18-20-22-26-27-28-30-32-36-40-48-56
25/64	16-24-27
.400	24
13/32	12-14-16-18-20-24-27-32-40
27/64	28
7/16	12-16-18-22-24-26-27-28-30-32-36-40-48-56
29/64	12
15/32	12-14-20-24-27-28-32-40
1/2	12-14-16-18-22-24-26-27-28-30-32-36-40-48-56
33/64	12-13-20
17/32	10-12-13-14-16-18-20-27-32-40
.550	24
9/16	13-14-16-20-24-27-28-30-32-36-40-48
37/64	12-27
19/32	12-18-20-24-32
5/8	9-10-12-13-14-16-20-24-27-28-30-32-36-40-56
41/64	11-18-24
21/32	10-11-18-20-24-27-32-40
11/16	20-.004
11/16	11-12-14-16-18-20-24-27-28-30-32-36-40
23/32	11-16-20-27-32-36-40
47/64	10-16
3/4	9-11-12-14-15-18-20-22-24-26-27-28-32-36-40
49/64	10-16
25/32	10-16-20-27-32-40
.800	16
13/16	10-12-14-16-18-20-24-27-28-32-40
.835	16
27/32	10-18-20-27-32-40
.850	14
7/8	8-10-11-12-13-16-18-20-24-26-27-28-32-36-40
.885	14
29/32	9-12-20-27-28-32
15/16	8-9-10-12-14-16-18-20-24-27-28-32-40
31/32	9-16-20-28-32
1	5-9-10-11-12-16-18-20-24-27-28-30-32-36-40-48
1-1/32	8-12-14
1-3/64	14
1-1/16	8-10-12-14-16-18-20-24-27-28-32
1-3/32	8-9-12
1-1/8	8-10-14-16-18-20-24-27-32
1-5/32	7-12-24-26-32-40
1-3/16	8-10-12-14-16-18-20-24-32
1.220	32
1-1/4	8-10-14-16-18-20-24-28-32
1-5/16	6-8-10-12-14-16-18-20-24-32-48
1-3/8	8-10-14-16-18-20-24-32
1-13/32	20
1-7/16	6-8-10-12-14-16-18-20-24-28-32
1-1/2	8-10-13-14-16-18-20-24-28-32
1-17/32	18
1-9/16	12-14-16-18-20-24-32
1-5/8	5½-8-10-12-13-14-16-18-20-24-28-32-40
1-11/16	10-12-14-16-18-20-24-32
1-23/32	5
1-3/4	5-8-10-12-13-14-16-18-20-24-28-32-40
1.7715	12
1.767	18
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	32
1-15/16	8-10-12-14-16-18-20-24-32
2	4½-6-8-10-12-14-16-18-20-24-32
2-1/16	12-14-16-32
2-1/8	4½-8-10-12-14-16-18-20
2-3/16	12-16-20
2-1/4	4½-8-10-12-14-16-18-20
2-5/16	12-16-18-20
2.360	18
2-3/8	4-8-10-12-14-16-18-20
2-7/16	16-20
2-1/2	4-6-8-10-12-14-16-18-20
2-9/16	12-16-18
2-5/8	8-10-12-14-16-20
2-11/16	12-16
2-3/4	4-8-10-12-14-16
2-7/8	8-10-12-16
2-15/16	12-16
3	3½-4-8-10-12-16-18
3-1/8	12-16
3-3/16	20
3-1/4	4-8-12-14-16-18
3-3/8	10-12
3-1/2	4-8-12-16
3-3/4	4-8-12-16
4	4-8-12
4-1/8	12
4-1/4	8

LEFT HAND TAPS AND THREAD PLUG GAGES

Size	Threads Per Inch
0	80
1	56-64-72
2	56-64
3	48-56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-32-40
12	24-28-32-40
14	20-24
5/32	36
3/16	32-40
1/4	20-23-24-25-27-28-32-40-48
.277	40
5/16	18-20-24-27-28-32-40
11/32	24
3/8	16-20-24-27-32-40
13/32	20
7/16	14-20-24-27-28-32-40
1/2	12-13-14-16-20-24-27-28-32-40
9/16	12-18-20-24-27-32-40
.622	8
5/8	10-11-12-16-18-20-24-28-32
11/16	11-12-16-18-20-24-32
.720	8-12
3/4	9-10-12-16-18-20-24-32
13/16	10-16-18-20
7/8	9-10-12-14-16-18-20-24-32
15/16	12-14-16-18-20-32
1	8-12-14-16-18-20-24-28-32
1-1/8	7-12-18-20-24-32
1-1/4	6-7-8-12-16-18-20
1-5/16	12-16-18-20
1-3/8	5-6-8-10-12-16-18-20-24
1-7/16	10-12-18
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	5½-8-10-12-16-18-20
1-11/16	8-10-12-16-18-20-24
1-3/4	5-8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	5-8-10-12-14-16-18-20
2	4½-8-10-12
2.215	20
2-7/32	20
2-¼	4½-8-12
2-5/16	24
2-⅓	4-8-12
2-11/16	16
2-3/4	4
2-7/8	24
3	4-8

RIGHT HAND—UNLISTED "GUN" OR SPIRAL POINTED TAPS

Size	Threads per Inch	Size	Threads per Inch
0	80 NF		
		⅞	9 NC, 14 NF
1	56 NS	1	8 NC,
2	56 NC, 64 NF		12-14 NF
9/16	12 NC, 18 NF	1⅛	7 NC, 12 NF
⅝	11 NC, 18 NF	1¼	7 NC, 12 NF
11/16	11 NS, 16 NF	1⅜	6 NC, 12 NF
¾	10 NC, 16 NF	1½	6 NC, 12 NF



RIGHT HAND—UNLISTED "PULLEY" OR EXTRA LENGTH TAPS

Size	Threads per Inch	Size	Threads per Inch
4	40 NC, 48 NF	⅜	24 NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	½	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	⅝	18 NF
¼	28 NF	⅝	16 NF
5/16	24 NF	Also Larger Sizes NC & NF	

RIGHT HAND "PIPE" TAPS

TAPER "NPT" Size	TAPER "NPT" Thread	STRAIGHT "NPS" Size	STRAIGHT "NPS" Thread	EX. LENGTHS TAPER "NPT" Size	EX. LENGTHS TAPER "NPT" Thread
1/16	27	1	8	1/16	27
¼	27	1/16	27	⅛	27
2½	8	1¼	11½	¼	18
3	8	1½	11½	⅜	18
3½	8	2	11½	½	14
4	8	2½	8	¾	14
		3	8	1	11½
		3½	8		
		4	8		

LEFT HAND 'PIPE TAPS' TAPER AND STRAIGHT

Size	Thread	Size	Thread
1/16	27	1	11½
⅛	27	1¼	11½
¼	18	1½	11½
⅜	18	2	11½
½	14	2½	8
¾	14	3	8

"OVERSIZE TAPS"

RIGHT HAND N. C. and N. F. SIZES

MACHINE SCREW No. 2 TO No. 5 PLUS .002 TO .003

MACHINE SCREW No. 6 TO No. 14 PLUS .003, .005, .010

FRACTIONAL ¼" TO 1½" PLUS .003, .005, .010 AND .015

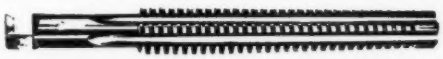
"UNDERSIZE ALSO AVAILABLE"

"PRICES OF SPECIALS ARE GOVERNED BY QUANTITY ORDERED" PRICES QUOTED UPON REQUEST

REGULAR LISTED SIZE TAPS AND TOOLS IN STOCK FOR IMMEDIATE DELIVERY

ACME TAPS

AVAILABLE FOR QUICK DELIVERY



2 WEEKS DELIVERY—When ordering or requesting quotations, kindly furnish us with the following information:

(a) Kind of material being machined.
(b) Depth of hole, through or bottom.
(c) Tap to be used horizontally or vertically.
(d) Will tap turn, or is piece expected to be turned.
(e) Is tapping job expected to be done in one pass.
(f) Would tap be backed out of hole, or machine stopped for release of tap.
(g) If possible, submit thread length, and overall length of tap desired with a blue print.

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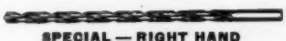

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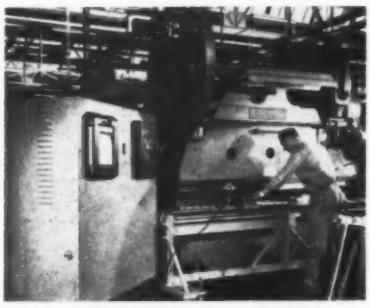
Special Machines

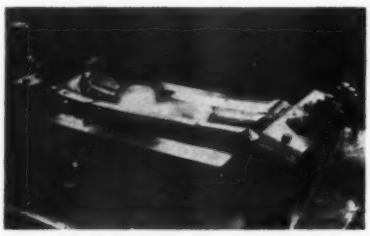
MARTIN RESISTANCE HEATS TITANIUM FOR HOT FORMING

Greater efficiency in resistance heating titanium is reported by the manufacturing engineering and research specialists of The Martin Co. when they resistance heat the titanium sheets to high temperatures and form it quickly while it is still hot. To do this, Martin has developed a special Power Pac, which uses a General Electric Reactrol control, Leeds & Northrup temperature controller, and a 50 KVA resistance heating transformer with 440-v, 60-cycle, single-phase primary and 10-20-40-v secondary.

Temperature sensing is accomplished with a Rayotube sensing element which can determine the temperature of the metal without coming into contact with it. The saturable reactor of the Reactrol control is connected in series with the resistance heating transformer and with a current transformer. The reactor permits an infinitely variable control of the power transformer, while the current transformer produces a feedback signal which limits the maximum current flow through a given size of material. This special multi-tap current transformer in the feedback circuit permits a range of material sizes from 0.064" x 5" x 124" to 0.064" x 19" x 32" and 0.032" x 7" x 88" to 0.032" x 28" x 22". All sizes within these dimensions have been formed satisfactorily.



The Power Pac, inside cabinet, can be used with operations other than drop hammer forming. Here titanium is heated before brake forming. The Rayotube is mounted on the fixture.



The drop hammer with the detail blank in position. The transformer leads are connected to the aluminum tabs that are welded to the blank.

The secondary leads of the power transformer are connected to opposite ends of the titanium sheet. When used with the drop hammer, the Rayotube is mounted clear of the hammer but focused on the approximate center of the sheet. When the power is turned on, the titanium is resistance heated. As it heats, the Rayotube, focused on the metal, detects and records the rise on the temperature controller. When the temperature of the part approaches the preset value, the "heat-up" power is reduced until it is low enough to maintain the heat at the desired level. The power is cut off by the operator at this point and the forming stroke is made.

The metal must overhang the die sufficiently, Martin reports, so the transformer leads can be connected to it. This is accomplished by welding aluminum tabs to the detail blank in the trim area. The titanium sheet must be insulated electrically from the lower die by coating the top of the die with a thin layer of Sauereisen. If the part requires additional forming, the die is raised and the whole cycle is repeated.

The Power-Pac has proven highly satisfactory for drop hammer forming, says Martin, because the proportional type controls maintain a closer temperature control than is possible with conventional on-off controllers.

AUTOMATED WELDER OPERATES INSIDE TUBULAR AXLE PARTS

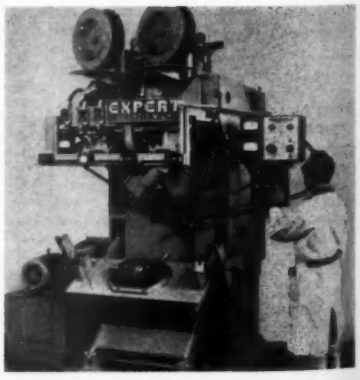
A single-station automated welding machine has been developed to perform difficult welding operations on the inside of tubular parts.

The machine, manufactured by Expert Welding Machine Co., produces linear reinforcement welds on the inside seam of the banjo section of rear axle housings at a rate of 250 pcs/hr. It is adaptable to any part requiring short linear welds.

Two welding heads are mounted at 45° angles on separate slides to permit entrance into the inside of the banjo section. The slides move in a horizontal direction during the welding operation. Both slides are driven by a common lead screw, which contains both a left and right-hand thread. The lead screw is operated by a vane-type hydraulic motor through a chain and sprocket drive.

The new welding process utilizes welding wire with a tubular cross section containing the flux. This permits welding in small or hard-to-get-at areas where flux depositing equipment would be difficult to use and where non-flux welding methods are less satisfactory.

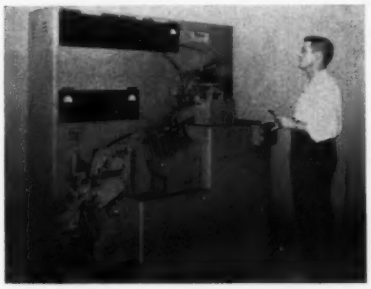
The machine is electrically-controlled, and air and hydraulically-operated. Welding current is supplied by two 600 amp generators.



ELECTRONIC MACHINE INSPECTS AND SEGREGATES VALVES

Concentricity of engine valve seat and stem, valve stem straightness, head thickness, and overall valve length are checked electronically with the latest Arlin inspection machine. More than 3,000 in-process or finished valves can be checked in an hour. The seat and stem concentricity check is independent of the size of the valve.

The machine, from Arlin Products, Inc., is controlled by an electronic cybernetic system. This system received signals from the compact inspection gage heads regarding concentricity, straightness, thickness, and length. It stores this information and relates it to solenoid-controlled gates in segregation chutes. After inspection, the valve is directed to the proper "rejection" or



"pass" chute.

Extremely accurate, compact, and simple Arlin gage heads are used to check valve dimensions. They do not contain any bearings, gears, racks, magnets, or coils, but operate on a radar-type reflected wave circuit using a frequency of 30,000,000 cps. They can operate to 0.000001" constantly with 100% repeatability and no wear even after years of service. The electronic circuit is of plug-in design, and it is divided into packaged units which may be removed easily for fast inspection or replacement.

Valves are fed to the machine from a standard 8½ cu ft hopper, equipped with an elevator and horizontal conveyor, and cybernetic and electronic controls which feed the valves at a continuous orientated flow. Because of the accurate incrementation of the electronic controls, a master valve is not required to set up the concentricity check; only the approximate size of the valve is needed. A valve of known size and which falls within the limits of the inspection dial is needed to set the other inspection stations.

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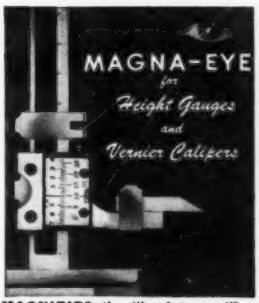

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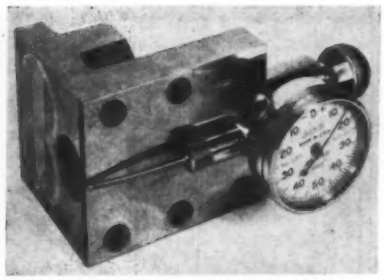

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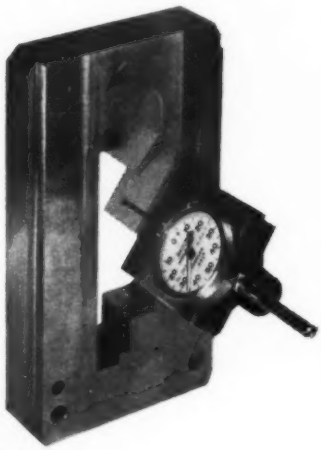

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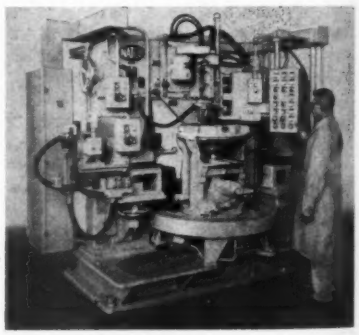
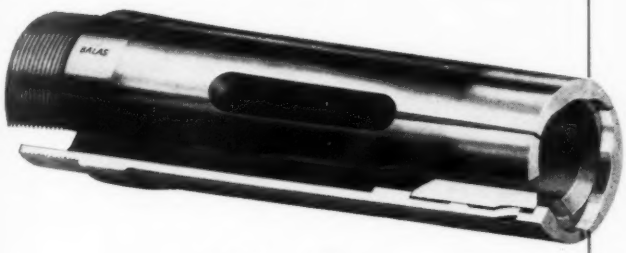


are used; on other parts several positions are skipped. A four-position switch on the electrical cabinet selects the table position and also the heads that are to move forward.

One man operates this machine as well as an adjacent adjustable arm vertical driller on which the through bolt holes are drilled. Cycle times are comparable so that the operator can unload and load one machine while the other is cycling. Production rates on this special machine range from 24 to 42 parts/hr.

FINGERS OF STEEL



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